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FARMERS DIGEST

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The Farmer's Digest

From more than two hundred magazines and bulletins published in this country and abroad, the Editorial Staff of the Farmer's Digest selects articles of outstanding merit and general interest. It is comprehensive in its scope, covering all phases of Agriculture.

The Farmer's Digest

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The Farmer's Digest

VOL. 1 JUNE, 1937 NO. 2

Hope for the Farmer

Condensed from The Forum

Russell Holt Peters

OF all our economic enigmas none has defied solution so sturdily as the farm problem. We have attacked it with all manner of theories; we have bolstered our panaceas with millions and even billions of dollars. And there it stands, as alive today as it was yesterday. It is not a problem indigenous to this nation, although we frequently forget this in our concern for our own troubles. It is not, most certainly, a problem of this particular generation. And we forget that, too.

We forget that farming has always been an unruly business in which the farmer first fights with nature for his crop and then fights with the city for his market. With the vagaries of nature the farmer can, in the long run contend. If the drought burns him out one year, he plants hopefully the next. But frequently the city is too much for him; the products of the farm overtake and pass the food needs of the city. And when that happens—as it has happened—we have a farm problem.

Because the farmer is offering the city more than it cares to buy, the city sets the price. And because the city is no open-handed philanthropist, it buys as cheaply as it can, just as the farmer sells as dearly as possible when he is in control.

Thus you may correctly say that the farmer's troubles are rooted in the evils of surplus. There are other evils, many of them of great importance, but this is fundamental.

Three administrations have tried to cope with the surplus, but its extermination is still a pledge of the incumbent government. We have tried to dump it on our European neighbors; we have tried to store it; we have thrown it into the river and plowed it into the ground; and through the AAA we have tried not to grow it at all. And in none of these things have we been completely successful.

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With the surplus we can do two things: seek its elimination through arbitrarily checking production or use it. There is no third choice.

To most of us the farm is a producer of food and little more. That may have been true years ago. It is not true today. The farm is capable of producing, also, organic matter useful to industry. We will, therefore, make our farms into units producing for both markets. By so doing we will restore the balance between supply and demand, the lack of which has been responsible for our farm problem for more than sixteen years.

There is, of course, more to it than that. There are the questions of warehousing against lean years; of utilizing neglected products which may do the job better than commodities now raised; of seeking, perhaps, temporary subsidies until markets have been firmly established.

Our immediate concern here, however, is with research thus far available to the farmer and to the industrialist who link hands in the new farm economy.

Autos Out of Beans

High in the list and of increasing familiarity to the general public is the soybean. Older than written history in the Far East, it has only just attained its majority in this country, which has formally acknowledged its status by admitting it to trading on the Chicago Board of Trade.

We now raise soybeans to the tune of $35,000,000 worth annually. More than 5,000,000 acres are devoted to it. Its planting time corresponds to corn, and it is harvested in 100 days. As a foodstuff it is invaluable to diabetics and vegetarians.

What is pertinent, however, to this discussion is the growing use of the soybean in industry. There it has a powerful sponsor in Henry Ford, who uses the output of more than 60,000 acres in the manufacture of his motor-cars.

Ford owners push horn buttons fashioned from soybean plastics. The trim which surrounds the windows in their sedans is of soybean, and they shift gears with a soybean handle. Soybean oil paints their cars and fills their shock absorbers. Their engines are cast in sand cores bonded with soybean oil.

But others than Ford pay belated recognition to the soybean. They include soap makers, linoleum and oilcloth manufacturers, paint and varnish executives, and a great number of industrialists, such as radio builders, who have use for plastics.

Illinois is the patron saint of the soybean, producing more than half the nation's crop. But other States are scrambling to catch up, and the real danger now is that, fascinated by news of the

soybean and its value, many farmers will plant it in unfavorable soil. And be worse off than before.

The Versatile Pine Tree

The South, looking for another industrial crop than cotton, is pinning its present hope on the slash-pine tree. In the warm South slash pine can be grown like a crop in a ten-year cycle. And the South has great plans for slash pine. Most of them spring from the researches of Dr. Charles H. Herty of Savannah, Georgia.

Dr. Herty has made newsprint from slash-pine pulp, and entire editions of newspapers have been printed on it.

Last autumn Dr. Herty made the most startling of his several startling announcements on the subject—that he had found fat in the woody part of his beloved trees. In a dispatch from Savannah the science editor of the Associated Press said:

Dr. Charles H. Herty has discovered fat in sticks of high commercial value.

The fat discovery was announced from the pulp and paper laboratory of Savannah where, for more than two years, Dr. Herty, white-haired scientific magician of chemistry, has been seeking a way to make bond and book paper and clothing from the south's huge pine forests.

His discovery of fat in the woody part of the trees and a cheap, easy way to extract it solved the paper problem. The south, he said, can make its trees immediately available for unlimited manufacture of the finest bond and book papers.

Preliminary experiments indicate, too, that removal of the fat may solve the clothing problem. The south has enough pine to clothe the whole world in rayon if it can be made from trees there the same as it is now made from northern spruce.

The tree fat also offers a new industry to the present newsprint manufacturing business, Dr. Herty said. For he found the same fat in spruce trees from which the world's present supply of newsprint and most of its white paper is made.

The fat in trees closely resembles that in human beings and animals. It will make also in almost unlimited quantities the kind of soap the mining industry is looking for to "float" its ores.

This fat will make paint, too, for it contains linoleic acid. It has also oleic acid, one of the recently found essentials of life in human tissues. The tree fats can supply the medical profession with endless quantities of cheap oleic acid for experiments.

The fats also contain a lot of waxes. One of them is chlores-

terol from which Vitamin D can be made.

Cotton to Build Roads

Farther west, where cotton is king, its producers hope for something from the present experiments of the government in road building. With an appropriation of $1,300,000 for experimental work, the government is studying the use of cotton mesh as a binder on macadam roads. Nineteen interested States have also made appropriations for the same purpose, and 565 miles of highway have either been given or are in the process of being given a cotton dress.

The cotton mesh is being used with macadam much as wire mesh is used with concrete. Chief argument for the cotton-treated road is a sizable reduction in maintenance cost. Because it resists upward pressure and makes the road almost waterproof, it is of great interest to the North, where sharp freezes destroy many miles of highway every winter.

To give a road a cotton treatment—and these treated roads are not trunk highways but secondary or farm-to-market roads —requires from eight to ten bales of cotton per mile. The south estimates that there is a potential market of 900,000 miles of highway for its cotton crop, or a maximum of 9,000,000 bales. Except for huge crop years, that is not far under an entire year's output.

Industrial Alcohol

These alliances of farming and industry are important. Someday they will be more so. Yet, for sheer magnitude, they cannot compete with an alliance now being fostered in the Middle West. It contemplates the linking of the farm and the distillery in the production of power alcohol.

For almost thirty years the farmer and the distiller have blown hot and cold on a program of mutual aid. Once, at least, they got together. Now they are together again, and alcohol is actually being produced for the sole purpose of supplying power through use in automobile engines.

In the United States, oil men have no use for power alcohol. Its production, they say, is an economic chimera, its value as fuel subject to great doubt. In Europe the tune is different, and later you will read of this in greater detail. It is sufficient here to say this clash of opinion between the petroleum producer and the power - alcohol advocate has produced an amazing collection of contradictory statements and figures.

What is important is that automobiles actually *can* be operated on a gasoline-alcohol mixture. Someday—and this is chemically possible—they may even be operated on alcohol alone.

Therefore, says the Middle West, we will produce for the alcohol market. And it is actually doing so in a small plant at Atchison, Kansas, first power-alcohol unit this country has known.

The Atchison plant opened last summer and shipped its first consignment last fall into Nebraska, where alcohol used as fuel is tax free by legislative edict. The plant is deliberately modest in size. It employs about 35 men, produces on a basis of 3,500,000 gallons alcohol annually, and requires 1,500,000 bushels of corn or its equivalent as raw material each year. Larger plants, its sponsors say, are not efficient. They must reach out too far for their materials. At that, according to plant executives, it requires the labor of 2,000 men in the fields to keep it in supplies.

When tentative operating figures were being drawn for it a year ago, corn was down. Setting an arbitrary price of 23 cents a gallon on alcohol to be produced, the balance sheet per bushel of corn worked out like this:

2.7 gals. alcohol at 23c	62.1c
15 lbs. protein feed at 1.5c per lb.	22.5
8 lbs. carbon dioxide (for dry ice) at 1c	8.0
Total	92.6c

Against this was set plant overhead, depreciation, a reasonable return on investment, and the cost of raw material. The first three were estimated at 9.5 cents per gallon, or 25.6 cents per bushel of corn. That left 76 cents for corn.

Now as a matter of fact, when the Atchison plant got down to the actual business of producing, the drought had come, and corn was skyrocketing.

At the time it must have been an unfortunate thing for the operators. To the farming Middle West, however, it was a blessing even though it had come in an unpleasant disguise. For it brought out sharply, at the very outset, the one great barrier to an alliance of farming and industry. And that is the widely fluctuating price of farm products.

No manufacturer accustomed to a reasonable idea of the future cost of his raw materials could be expected to contend with the fantastic price swings which have characterized agriculture during the past ten years.

In Atchison, almost overnight, the distillers saw their careful calculations destroyed by dying fields. They saw, on a small scale, what industry as a whole would see if provision were not made for this sort of thing. Perhaps warehousing against lean years will provide a partial answer. But in Atchison the lean year had already arrived, and they searched for another solution. From this search have come two things, one of them unique and both highly important to future farming.

First they arranged to have crops grown for them exclusively, on a contract basis, much as is done in the sugar-beet fields. Second and of much greater moment, they arranged for crops which they felt might be more satisfactory than corn for the production of alcohol.

In short, they laid the foundation for a self-contained industrial-agricultural unit, farming members of which will be assured an outlet for their crops and a reasonable price for them. The distillers, on their part, will receive raw material best suited to their needs and a stabilized price.

To return to our analogy of the farm as a factory, you find these things happening to the acreage around Atkison: Outmoded merchandise—in this instance corn—is being replaced by new and salable products, And it will not be dumped, willy-nilly, into an overcrowded market, but is already assured of its sales outlet. For the farm this is revolutionary.

Specifically, the distillers are asking the farmers to supply them with Jerusalem artichokes, the better varieties of sweet potatoes, and saccharine sorghums, all of them first-rate materials for the alcohol industry. For purposes of experimentation the farmers have been asked to make small plantings of these crops so that accurate yield figures, under practical farming conditions, may be obtained.

Says an official of the alcohol company:

"As a result of these experiences it is hoped that a crop can be found which will yield the farmer a better return per acre than he is now obtaining and which will supply the plant with a uniform flow of raw materials at a favorable price."

Of these crops the most interesting to the Middle West today is the Jerusalem artichoke, which is not from Jerusalem and is not an artichoke. It is, instead, a tuberous plant that has a second name of girasole.

Years ago it was considered a weed. Farmers spent many back-breaking hours rooting it from their soil. As a matter of history, it was a food crop cultivated by the Indians.

It has three qualities that make it of special interest to the Middle West: it can exist and mature with almost no moisture; it produces, under favorable conditions, an enormous crop; and it contains within itself the ability both to fatten livestock and to give up levulose, sweetest and most soluble of sugars.

This last property is of particular interest to the distiller. The first is of particular importance to a country that has known a succession of disastrously dry years.

Thus far we have been concerned with the problems of manufacture at Atchison. And those are the real problems, for marketing at present is no problem at all and probably will not become a problem until the number of alcohol plants greatly increases.

Before the Atchison plant turned out a single gallon, requests had been made for five times its capacity. Most of them came from independent petroleum dealers and from farmer co-operatives. And out where corn is raised these are not inconsiderable outlets.

The thought is to provide these distributors with two blends, one containing ten per cent alcohol, the other twenty. The first is designed to compete with standard-grade gasoline, the second with premium or ethyl grade. The farm chemists claim they are comparable in quality, and to agree or disagree is to let yourself in for a terrific argument.

From the petroleum men you will hear these blends criticized as chemically inefficient, economically ridiculous, and, as a substitute for crude, not comparable on a price basis with fuel secured through hydrogenation of coal.

The farm chemist will probably refer you to Europe, where not only are alcohol blends commonplace, but where they are actually required in some instances by government edict, in order to hold down petroleum imports.

How, he asks, can gasoline plus alcohol be perfect in Europe and unworthy of consideration in the United States?

The farm chemist will also lead you into a discussion of dwindling petroleum supplies in the United States and the need for their conservation.

Finally, he will bolster his argument for blends by saying that substitution of only ten per cent alcohol would require no less than 1,600,000,000 gallons, as judged by the present motor-fuel requirements of the nation. To raise raw material for that much alcohol would require the services of 1,500,000 men in the fields and distilleries. It would displace no distributors. It would require 600,000 bushels of corn or their equivalent, which is one fourth of a normal corn crop and 40 per cent of the 1936 crop. It would mean the construction of 500 plants similar to that in Atchison. Best of all, it would be a major solution of the surplus problem.

Still in the background but in process of development are other brain children of the agricultural laboratories.

Finding "Par" for Dairy Cows

Condensed from Hoard's Dairyman

E. C. Norden

CHARLES STAFF, animal nutrition authority, has prepared a series of standard production graphs for dairy cows that are helping dairymen to learn the facts about their business. They provide a standard of comparison for judging the production record of any particular cow. They show the rate of decline in lactation that may be reasonably expected. Fifteen years of painstakingly accurate record keeping has made possible these standards.

"A dairyman needs to know what he has a right to expect of a cow before he can make sure he is getting it," says Mr. Staff. "He needs to know the reasonable standard of achievement—or par as they say in golf—under favorable conditions.

"If you have a cow which gives, say, 35 lbs. milk daily at the peak of its production, how much milk in all should that cow give during a lactation period of 360 days? If the lactation period is shorter, possibly 300 days, or 330 days, how much difference will this make in the amount of milk that cow should produce? And here's another question—suppose that cow should give, as the standard graphs indicate, approximately 9,465 lbs. milk in a 360-day lactation—how much of that amount will she have given by the 40th day, or the 150th, or any other day? How fast will she produce milk?

"It's a great business — this dairying. We all are running milk factories—and yet we know very little about how much milk we're going to produce or when we'll produce it. We don't even know if our 'milk machines' produce what they ought to.

"I'm too inquisitive, I guess, to be willing to run a dairy farm that way. My friends in the milling business can tell me the capacity of each machine in their factories, how much flour and feed they expect to produce, and when they will produce it. I made up my mind that I was entitled to the same information about my dairy cows. That's why I have kept records for twenty years. That's why I worked out these standard production graphs."

To find the answers to these hard questions that bother dairymen, Mr. Staff commenced more than twenty years ago to keep

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records of the performance of cows on the farm under his management just outside Detroit. The herd was a mixture of grades and pure-breds. His interest in record keeping was purely practical. He wanted to make more profit. To do so, he needed to know whether or not he was getting maximum production from each cow.

In trying to find out what should be "par" or reasonable production for each cow, he recognized that many influences affect the amount of milk a cow gives. These are: hereditary ability to produce, age, health and condition, supply of water, care and management, environment, weather conditions, character and quantity of the ration, date of freshening, and date of breeding.

Exact records were kept on every one of these points for each cow. These records showed in milk production the effect of any variation in these conditions. Insufficient water, disturbance at milking time, a change in feed or weather—every point showed up on the milk record. By noting these changes, it became possible to handle these cows so as to obtain top production.

Just how this worked out can be seen in the case of Cow Number 155, otherwise known as Friend Pietertje Gelsche Korndyke. She was purchased by the Research Farm when she was six years old. Her former owner sold her because although she was a good producer for a short time she did not hold up in production. That was fourteen years ago! Under correct handling, this cow produced 187,000 lbs. milk in the twelve years' time since then. She has a record of 30,536.8 lbs. milk in 365 days. Today this cow is over 19 years old! And she had a sound calf every year until 1934. Now she's showing gray hairs on her forehead and has retired from active production.

But note this: Number 155 weighed 998 lbs. when purchased, when she was said to be a short time producer only. Record keeping provided information which enabled the farm to bring her body weight up to 1,500 lbs.—and her "par," or reasonable production under good conditions, jumped to an average of 20 quarts of milk a day for 11 straight years including her dry periods. You can check the figures in regard to this cow with the Holstein-Friesian Association of America, and the Wayne County, Michigan, Herd Improvement Association.

No doubt this cow inherited exceptional milk producing ability. But her first owner never brought her up to "par." Record keeping and correct handling produced 50 per cent more cow through her weight increase, and set a standard for sustained high production.

This cow happened to be a pure-bred. But grade cows under the same careful record keeping and handling do remarkable things. Mr. Staff calls attention to 14-year-old Number 132 that produced 15,000 lbs. milk and 500 lbs. fat on twice a day milking in one year.

So his contention that it pays to find out what "par" is for a particular cow and then handle that cow to get it, is well sustained.

Records kept at the farm contain accurate information covering over 500 "cow years." They are the cow's own story of how much milk she can produce under good conditions.

In arriving at a standard basis, or "par," all abnormal records were eliminated. Only those of normal cows were included. These were then classified according to the milk produced by each cow in her highest ten-day period, or the peak of her lactation. These groups ranged from 25 lbs. peak production daily to 65 lbs. daily. In all, 17 peak productions were classified. These commence at 25 lbs. daily peak production, next is 27½ lbs., next 30 lbs., next 32½ lbs., and so on in 2½-lb. steps up to 65 lbs.

These records were further classified according to the date of breeding, since this governs the length of the lactation period and the amount of milk produced. In one class were cows bred approximately 80 days after freshening. These would be in milk for about 300 days. In another class were those bred 110 days after freshening, giving a lactation of about 330 days. In another group were those bred 140 days after freshening with a lactation period of about 360 days.

Averages were next made of the milk production of each group during the entire lactation. These figures were then compiled and plotted on graph paper. From these, standard milk production graphs for cows in each group were made.

Hard? Yes, a very hard thing to do—but the graphs are simple as A, B, C to understand.

Let's have a look at one of them. Suppose you have a good family cow giving 40 lbs. of milk daily at her peak. Her peak? What's her peak? Well, it's the time when she gives the most milk, and it usually occurs thirty or forty days after she has given birth to a calf. The amount of milk the cow gives at that time shows what graph to use for her.

All right—you find she gives 40 pounds of milk daily at her peak. Now select the standard production graph for that amount, and you'll see just what to expect.

Let's suppose that this cow has

been bred 140 days after freshening. The graph shows that she'll have a lactation period of about 360 days, and that during that period she'll give approximately 10,615 lbs. milk. She'll rise from about 35 lbs. daily average in the first ten days to 40 lbs. at between 30 and 40 days. Then she'll start declining gradually, very gradually. In the next six months her daily production will decline only about ten pounds. But after that the milk flow will decline rapidly. At the end of ten months after the start of lactation you can reasonably expect only about 22½ lbs. milk daily from this cow. And at the end of eleven months you should expect approximately 17½ lbs. daily.

So don't blame it on the feed or the cow when the milk flow declines very rapidly during the last three months of lactation. That's normal. The records prove it.

Although neither the family cow nor the dairy purebred knows anything about these graphs, they follow them very obligingly.

Let's look at the way Cow No. 372, a grade Holstein in her fourth lactation, co-operated. The graph said she ought to give about 14,858 lbs. milk in a 360-day lactation period. She gave 14,922 lbs.—a bit more than the standard for good measure. And she gave it practically as the graph outlined except for two very hot spells when the humidity bothered her.

If you were planning on selling milk from this cow, you could tell from this graph: First, that her peak production is 57½ lbs. milk daily, and that she reached it 30 or 40 days after she started milking. You can tell approximately how much milk to expect from her during each 30-day period. For example, during the 30-day period from her seventh to eighth month of lactation the graph says she should in the beginning be giving about 41 lbs. daily. And she did. Her production rose a trifle above this. At the end of the 30 days she was supposed to have declined to about 38 lbs. daily—and she had. Hot weather then set her back a bit, but she picked up more than proportionately, and followed the curve of the graph very closely until the end of the 360 days when the graph expected 10 lbs. of milk daily, and she gave about nine.

Talk about factory production records! Here it is in black and white for the dairy. You know what to expect every ten days. But there is a very important proviso—which is that the cow must be in good health and condition, under proper environment and have good feed and good care.

The amount of milk given at the peak of production is the guide or index for the group in which each cow belongs. How much milk to expect and how rapidly lactation will decline is governed by this factor in combination with the date of breeding. The production curve of cows varies greatly according to their peak.

The records show that the higher the peak of production the faster the cow declines in milk flow. This is because the cow with high peak production has to decline so much farther in order to reach zero in the same number of days as a low producer. The cow with a peak of 65 lbs. daily has to drop 65 lbs. to zero in 360 days, whereas the cow with a peak of but 25 lbs. has to drop only that much to reach zero. Consequently the rate of decline for low producers is much less sharp than for high producers.

This answers a question that has worried more than one dairyman. Often when a high producer drops off sharply her owner is worried, blames the feed, or some other condition, when the fact is she is behaving normally.

Mr. Staff is a mathematically-minded business man who has given particular study to those questions which affect dairy profits. He doesn't give a rap for statistics and graphs unless they show him how to get the facts that will help a dairyman make more money.

Take this matter of comparing the production of two cows. Most comparisons are anything but fact. Our records show that a true comparison can be made between cows only by comparing them at the same exact stage of lactation. How many days the cow has been in milk must be known before any fair comparison can be made. Two cows might give the same amount of milk on a given day and yet not be similar producers at all, if on the day in question one had been in milk 200 days and the other only 120 days. Cows can be compared truly only by knowing their peak production, and then comparing their performance on the identical days of their lactation periods.

"Another fact we have found is that the date of breeding has a definite influence in keeping the cows up in milk production. We have experimented with three different breeding dates and noted the effect on the milk flow. We bred 80 days after lactation, 110 days, and 140 days. This was done in order that lactation periods of 300, 330, and 360 days might be checked.

"Our records indicate that early breeding leading to a 300-day lactation period is generally more profitable over a period of years. We came to this conclusion

by taking into consideration both the amount of milk and the number of calves obtained from each cow. Considering the increased number of lactations and the greater number of calves possible over a period of years with shorter lactation periods, early breeding seems most profitable.

"Then there's the old question —'How can I tell which ration is best?' Our records show that the value of a ration cannot be determined by any immediate effect on milk production. The value is shown largely by the production of cows over the entire lactation period, both as to the initial quantity in the early stages of lactation, and the ability of the cow to hold up in production. If a change is made in the ration within the last 90 or 100 days of the lactation period, it's unreasonable to expect the milk production to show any increase because the cow is definitely headed to zero production.

"The question is often asked as to whether different breeds of cows will have the same normal rate of decline in milk production. Studies made by Professor C. H. Eckles indicate that they do. And our own studies support this conclusion, provided that the cows are of good type and breeding, in good health, good environment, properly fed and under good management.

"I have no time for theoretical farming. Our graphs of standard milk production are not theory—but fact. We have found them very important in studying the various conditions, either feeding, or care and management, which affect milk production. They tell us what each cow should be doing. They warn us immediately if she fails to do it. They tell us when we have corrected the condition that pulled down her production, whether it was the character of the feed under test, the quantity of the feed, the character and quantity of the roughage, the weather, the environment, or the care and management, or the health of the cow. These standard production graphs have told us as never before the facts about our dairy herd."

These production graphs have been released for the benefit of the entire dairy industry, so that all dairymen may have facts with which to answer their questions about milk production.

Diesels in Agriculture

Condensed from Penn State Farmer

L. J. Fletcher

THE Diesel powered tractor has recently been introduced and its great saving in fuel costs opens a new avenue for reducing farm costs of production.

The Diesel which is often considered new is, in reality, almost as old as the spark ignition engine. The major difference between the Diesel type and conventional spark ignition engine is in the method of igniting the fuel. The Diesel engine fires its fuel by injecting it into air heated by compression. This ignition principle was patented by Dr. Rudolph Diesel in Europe in 1892, and in America in 1895. Three years later, the first commercial built Diesel engine was put into service in St. Louis, Mo.

In this country the need for large power plants for stationary and marine purposes, during the period from 1900 to 1925, was being filled with Diesels, the demand for smaller engines with gasoline engines. Eventually the two types overlapped each other in power and then the public discovered that Diesel economy might be available not only in large engines but small ones as well. Immediately they wanted to know why smaller Diesels could not be built. This looked like an easy problem: To make it like the big engines only smaller. Such was not the case, for research engineers found that when the size of bore and stroke decreased, the technical problems increased.

The tractor-using public expected the Diesel to match gas engine performance plus Diesel economy. This expectation has been the dominant reason for the rapid refinement in the small tractor Diesel engine. The early investigations indicated that a tractor Diesel engine should have the following characteristics:

1. Ability to idle.
2. Smooth operation at all speeds.
3. Burn a wide variety of fuels.
4. Free from field adjustments.
5. Low maintenance costs.
6. Protection against dust.
7. Simple and positive means of starting.

Each of these requirements was an obstacle to overcome through engineering research. After five years of research these were overcome, and in 1930, the

Reprinted by permission from Penn State Farmer

first production model American Diesel tractor was put to work. Today, it is rather difficult for the layman to differentiate between the gasoline and Diesel engines, judging only by exhaust sound and pick-up under load. The speed range of most Diesels is approximately the same as for gasoline tractor engines, of comparable size, and they respond as quickly to change of loads as do gasoline engines. They are equipped with the same type of hand operated speed controls that permit adjusting the governor to any one of up to twenty or more engine speeds.

Seven years ago when the Diesel tractor made its first appearance, there was often a problem of obtaining desirable fuel. Today, all of the major oil companies are able to furnish a satisfactory Diesel fuel.

The Diesel tractor engineers deserve special recognition for the masterful way they eliminated field adjustments. This is an outstanding contribution to Diesel engineering. The fuel pumps and injection valves are accurately adjusted at the factory and all are exactly alike. Should a fuel valve need replacing after long service, the engine owner can secure a new one from his dealer at a moderate cost. The owner installs the new valve by loosening the fuel line and removing the two nuts that anchor the valve to the cylinder head. The new valve is dropped into place and connection re-established. There are no adjustments to make at the time of installation. In fact, no adjustments can be made in the field.

The pump is equally easy to replace. The life of the fuel pumps and injection valves depend upon two factors:

1. Buy clean fuel and keep it clean.
2. Regular care of the fuel filters.

A typical example of pump life is reported by the Humboldt Farming Company, Northcote, Minn., who own five Diesel tractors, which have each operated over 12,000 hours with the original fuel pumps.

Dr. Diesel's first experimental engine was started by introducing gun powder into the cylinder. The results were disastrous. The engine blew up. Other methods were then used, such as compressed air, the electric motor, the electric starter (using a storage battery), conversion engine types, and the auxiliary engine. Since the demands on the starting system are inversely proportional to weather temperatures, it is necessary to have a starting system capable of operating for indefinite periods of time. The auxiliary engine method of starting the Diesel proved to be the simplest and most dependable for all weather conditions.

The main feature of the Diesel engine is its high compression. This high compression is employed for obtaining fuel ignition by the heat of compression. In order to build long life into the truly high compression engine, the engineers have developed special alloy steels and made adequate provisions for the extra stress placed upon the bearings and connecting rods. Due to the extra strength built into the engine, additional life has been added to the Diesel as compared with the gasoline engine. For example: In 1933, Mr. W. C. Beasley, a California rancher, bought a Diesel tractor and since then it has operated over 14,000 hours. This normal period of performance was made without any major engine repairs. An automobile operating this length of time at forty miles per hour would have traveled 560,000 miles or equivalent to twenty-three times around the world.

The primary reason for the development and use of the Diesel is its economy. Diesel economy is based upon:

1. Each pound of Diesel fuel produces much more useful work in the Diesel engine than a pound of gasoline in a gasoline engine, and
2. Use of a fuel that weighs more per gallon than gasoline.
3. Diesel fuel costs less per gallon than gasoline.

This allows three different ways to translate the results of field trials. To illustrate, take two tractors of the same make and power—one with Diesel engine and the other with gasoline and compare them on the foregoing basis. (Nebraska Test Nos. 243 and 244.) The laboratory equipment, where these recognized tests are conducted, is designed to measure the amount of work done by an engine and to weigh the fuel consumed while doing that amount of work. Therefore, the economy of the engine is first computed in terms of pounds of fuel consumed per h. p. hour of work accomplished.

Thus, the relative economy of these two engines on the 100 per cent maximum load tests for the Diesel and the operating maximum load tests for the gasoline engine can be stated:

A Diesel engine does thirty-nine per cent more work on the same weight of fuel than a gasoline engine.

This method of stating relative fuel economy, which is in general use by engineers, is of little value to engine users.

The engine user buys fuel by volume and not by weight. In Test No. 243, Diesel fuel weighs 6.99 pounds per gallon, and in Test No. 244 gasoline weighs 6.17 pounds per gallon, a difference of

.82 pounds per gallon. When fuel economy is based upon volume of fuel, comparative economy can be stated:

A Diesel engine does fifty-seven per cent more work than gasoline engine on same volume or gallonage of fuel.

Accurate though these comparisons are, they do not involve cost of fuel. In the final analysis, the user is interested in costs. Assuming a price of $0.05 per gallon for Diesel fuel and $0.10 per gallon for gasoline, the relative economy of the two engines can be stated:

A Diesel does 214 per cent more work than gasoline engine on same cost of fuel.

The Diesel shows a higher relative economy at part loads than at full loads. This is because the Diesel operates at high compression at all loads, whereas engines with restrictions in the intake manifold, such as throttling carburetors or mixing valves, operate at relatively low compression at part load, as compared to the compression at full load. Referring to the Nebraska Tests, already mentioned, the economies of these engines, on the basis of cost of fuel on a quarter load, this comparison can be made.

A Diesel engine does 235 per cent more work than gasoline engine on same cost of fuel.

The only conclusion that can be drawn from these analyses is that the average reader finds it difficult, or even impossible, to assimilate the apparently garbled reports on the two types of engines. It is conceivable that a series of news dispatches reporting these two tests might contain all of the above percentages, varying from thirty-nine per cent to 235 per cent, all at the expense of hopeless confusion in the minds of the readers.

The average reader is not interested in percentages, for fuel bills are paid in dollars. If he is living at Mt. Pleasant, Pa., and his neighbor, the Westmoreland Homestead, is pulling four fourteen-inch bottoms, plowing one and three-quarter acres per hour, one and three-quarter gallons of six-cent Diesel fuel an hour, that make dollar sense. Mr. N. P. Mitchell, of Yuba City, Calif., writes that every hour he operates his thirty horse power Diesel tractor, he saves fifty cents as compared to the power he was formerly using which was of identical size but had a gasoline engine. In the few years that he will use this tractor 10,000 hours, his savings will pay for the tractor, not once, but twice.

Hundreds of examples could be quoted of farmers plowing for a fuel cost of six and seven cents per acre; fuel bills of approximately $1.00 per day.

What form of power known to man can compete with these

figures. Can horses? The answer is distinctly, "No." The United States Department of Agriculture and various colleges have many times reported that the cost of keeping a horse is approximately $1.00 per day. A thirty horsepower Diesel tractor will replace twenty to twenty-five horses. William Weir, at Waterville, Wash., states that his Diesel tractor had replaced twenty-six horses on his farm. He estimates that these twenty-six horses cost him $10.00 out of pocket expenses to plow twenty acres a day. This is a cost of thirty-six cents per acre out of pocket cost alone. His Diesel tractor has plowed thirty-three acres per day at a fuel cost of $1.90, an acre cost of only six cents; a saving of out of pocket cost of five-sixths.

Many horse advocates contend fuel represents no out of pocket expense, for their food is raised right on the place. The time may not be so far off when the farmer will be raising the fuel for his tractor. In Europe this is being done today. At the Ford exhibit at the Century of Progress Exposition in Chicago, in 1934, a seventy-five horse power Diesel engine furnished power to extract oil from soybeans and in turn the Diesel engine used some of this oil for fuel. The engine operated without interruption of service during the entire Exposition. The practice of raising soybeans for Diesel fuel oil now appears many years away, but from a conservation angle, this may be an answer to the geologists' warning that we must look for other sources of fuel than petroleum for our power plants. If a farmer raised twenty acres of soybeans, instead of setting it aside for pasture, he would improve his land and produce about 400 bushels of beans, based upon a twenty-bushel per acre yield. These beans will produce 450 gallons of oil and there would be a by-product of 10 tons of meal which is an excellent protein feed. The average horse delivers approximately 700 h. p. hours per year. The 450 gallons of soybean oil produced from the twenty acres will do the work of eight horses when used in Diesel tractors.

The Diesel engine has brought lower production costs to agriculture. Profit in any business depends as much on low production costs as on high selling price. Production costs are more under the control of the individual farmer, whereas selling prices are influenced by a multitude of factors. Today, many farmers are conscious of these facts. Those who have switched to Diesel tractors predict the Diesel engine is destined to revolutionize the farm tractor.

Things to Know About Fruit Pollination

Condensed from Pacific Rural Press

Professor W. P. Duruz

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FRUIT pollination is a fascinating subject and a vitally important one to all orchardists because the success or failure of an entire crop rests on proper fertilization and the setting of fruit.

Pollination is the transfer of pollen from the male part (anther) to the female part (stigma) of the flower. This may be accomplished by the falling or placing of the pollen on the stigmas of the pistil of the same flower or it may more generally be brought about by insects, particularly honeybees (for most fruits), and by wind in the case of nuts. The pollen grains stick in the viscid liquid on the stigma and with favorable conditions germinate, sending out their filamentous pollen tubes which extend down the pistil in the direction of the ovules (later the seed). Fertilization is effected when the nuclei of a pollen tube unites with that of the female ovule. Fertilization between pollen and ovule of flowers of the same plant is known as self-fertilization and that between different plants is cross-fertilization.

The growth of the pollen tube requires from a few hours to a couple of days for most fruits (in the case of filberts there is an extreme range of three or more months). This rate is more rapid in the case of incompatible ones. Temperature may also play a part in advancing or retarding the rate of growth.

Fertilization is the start of seed formation. The cells and tissues surrounding the ovules develop and differentiate into the various parts which become the resultant seeds and fruit. If a variety sets fruit with its own pollen, it is spoken of as self-fruitful, but if not, it is self-unfruitful and if two varieties set fruit with pollen of one another, they are inter-fruitful, or if not, they are inter-unfruitful.

These terms are generally confusing and so the common use is to speak of varieties as self-sterile, or inter-sterile or inter-fertile. Some fruits, however, develop without the stimulus of pollination or fertilization, as is found in the case of the seedless orange, the banana, the pineapple and seedless grapes. Some

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times with incomplete fertilization, part of the fruit will remain undeveloped while the fertilized part develops normally.

Among the causes for the failure of fruit trees to set fruit may be mentioned the following:

1. *The pollen is not shed at the time when the stigmas are receptive.* In some of our fruits and nuts, the pollen may be shed before or after the stigmas are receptive. The Franquette walnut is a good example of this, for oftentimes the pollen is shed on all the catkins before the pistils have become receptive. Under such conditions, it would be advisable to have distributed throughout the orchard or in the proximity of the individual trees a variety in which the pollen matures when the majority of the pistils are receptive.

2. *The pollen is not viable.* The pollen of some varieties is impotent. Some varieties of grapes and strawberries have imperfect stamens and hence are unable to furnish pollen for any kind of pollination. The J. H. Hale peach yields only shriveled and abortive pollen grains which are functionless in fertilization. Some varieties of apples and Duke cherries produce poor pollen. In unfavorable seasons other varieties which ordinarily produce good pollen may have weak, abortive or injured pollen. In order to correct this situation, it is important, therefore, to have one or more potent varieties that supply viable, compatible pollen at the right time for fertilizing a desired variety.

3. *Imperfect flower.* Some kinds of fruits are dioecious, that is, the male or staminate flowers are borne on separate plants from the female or pistillate flowers. Certain varieties of strawberries, grapes, figs, dates, papaya, most English holly trees, and others belong to this class. In planning for the pollination of these, it is necessary to have pollen bearing individuals available.

4. *Unfavorable weather conditions.* Failure of fruit to set may be due to frost, cold, windy or rainy weather which delays the growth of the pollen tube or interferes with the movement of insects, or severe rains which come immediately after the pollen is brought to the stigma, which may wash the grains off, or low temperatures during the winter or spring months, which cause weakness or deformity in the pollen or ovules or both.

5. *Lack of, or interference with pollinating insects.* There is a mass of evidence which indicates that in most of our fruits, pollen carrying insects such as the honeybee, wild bees, and bumble bees are necessary. It has definitely been shown that the percentage of flowers setting fruit is directly dependent upon the

activity of bees. The honeybee is stated to require a temperature of about 65° F., before its work is fully effective, while bumble bees work at a lower temperature, but the latter are not abundant enough to do all of the pollinating. Wild bees account for only fifteen to twenty per cent of pollination and orchardists now plan for their own bees and usually make arrangements to have one strong hive for each acre of trees. Spraying operations are regulated to avoid interference with or death of the bees, and everything is done to keep the bees strong and healthy to do the work of pollination.

6. *Incompatibility*. If a flower does not set fruit when pollinated under favorable conditions it is said to be incompatible. The reasons for this situation are not altogether understood. There is evidence indicating that with a self-incompatible variety the pollen tube grows at a slow rate, while in a cross-pollinated, with pollen from a compatible variety, the pollen tube grows at an increased rate. Even though two individuals may be of the same variety, the strain is an important factor in this consideration. For example, it is known that certain tested strains of Royal Ann and Black Republican sweet cherries will pollinate each other while some other strains may not.

7. *Miscellaneous Factors*. Among the influences causing flowers to fail to set besides the ones mentioned above, are deficient water supply to the fruit, and lack of ready available nitrogen in the soil two or three weeks before blooming time. Such practices as irrigation, fertilizing, pruning and cultivation must be regulated to take care of these conditions. Lack of drainage, winter injury, girdling, insect pests and diseases, are other factors which have a bearing upon this important phenomenon.

There are several methods for correcting unsatisfactory setting of fruit. The proper pollinizers must be provided that will overlap in the blooming and will be compatible with the principal varieties. Next, they must be placed rather near to the variety to be pollinated and, finally, the pollinating agents (honeybees) must be provided in sufficient quantities to do the work necessary to distribute pollen to practically all of the blossoms in order to have a full set of fruit.

In the original starting of a fruit planting, one should first inquire into the pollination requirements of the varieties he has in mind. Experiments and experience have indicated which varieties require pollination and which seem to be the most suitable pollinizers for the respective varieties. Too many people make

the mistake of planting solid blocks and learn when these come into bearing that they do not set fruit properly if at all. Self-sterile varieties should not be planted alone, neither should inter-sterile varieties be planted together. A mixture of compatible varieties and, in some cases, even the most compatible strains of proved varieties, should be the objective in mind.

It is advisable to follow a system in planting the pollinizers so that they will be in the center of a group of trees of the principal variety. Planting in alternate rows or every other tree in every other row or every third tree in every third row will give satisfactory distribution. This may be more efficient than planting rows or blocks of different varieties but when a compatible variety is used as pollinizer it is generally more practical to plant two rows together for convenience in spraying and harvesting.

If the trees are already established and it is discovered that pollination is required, certain trees may be grafted over to the pollinizers, placed so as to give distribution as stated above. It must be borne in mind, of course, that the grafts will not bear blossoms for several years and the solution of the problem will still require attention during the time the grafts are growing.

A temporary yet effective means of providing pollinizers is to bring in branches with blossoms and placing these in buckets or barrels of water set at intervals among the trees. Limbs 1½ to 3 inches in diameter are better than smaller ones, and they should be kept fresh throughout the blooming period. The influence of blossoms is noticed in the immediate vicinity of these bouquets and they may be placed at the base of every tree with good results. The use of bouquets is recommended for the testing out of doubtful pollinizers and for supplying blossoms during the time that grafts of pollinizers are developing.

Bees are absolutely necessary to carry the pollen for most of our fruits. Honeybees are searching for pollen and nectar to be used in their hives, and in so doing, they visit the fragrant flowers. Pollen grains from the various flowers adhere to the bodies and legs of the bees and thus pollen of different varieties is transferred from one blossom to the other. Climatic factors such as temperature, sunlight, wind, rain, and fog influence the flight of bees. Also, the vigor and health of the bees themselves determines whether or not they range actively and early and all of the days during the blooming season. Spraying the trees and cover crops just before or during blooming may be injurious to the

bees, causing them to be weak or actually killed by such mixtures as arsenicals or tobacco compounds.

After the fruits have set, they are competing with one another for water and nutrients supplied by the tree. The tree in the spring is making great demands on the water and nitrate supply of the soil. If this supply is inadequate, some or all of the blossoms and young fruits may be shed. If the tree is lacking in vigor and reserve supplies, the drop of fruit may be very severe. Orchard practices, such as turning under a cover crop during, or too soon after blooming, may cause a setback in the formation of nitrates; or deep cultivation may prune off young roots so as to reduce the moisture supply, thus causing a certain fall of blossoms or young fruit.

Insect pests and diseases may attack young fruits and cause them to drop or develop abnormally. Spraying on time and thoroughly is, therefore, important to keep down these troubles. Spring spraying with sulfur compounds may cause a shedding of the flowers or young fruit, especially if the tree is in a weakened condition. Lack of pruning, girdling of the trunk or limbs might also produce failure in set of fruit.

Time

The approximate labor requirements for farming are decreasing. The man hours necessary in growing and harvesting an acre of wheat when the most modern equipment available was used are as follows:

1830	**57.7 man hours**
1896	**8.8 man hours**
1930	**3.3 man hours**

Pasture as Balanced Feed for Livestock

Condensed from The Jersey Bulletin

R. H. Lush

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IT is a well established fact that good pastures furnish cheaper feed than any other farm crop, except in a few sections of the South. That high quality pastures ably supplement the ordinary rations of farm animals is increasingly evident. This is especially true in the case of poultry, all of which may suffer from a serious deficiency of vitamins A and D unless good pasture or some substitute is available. Succulent pastures have a stimulating effect that cannot be satisfactorily measured by chemical means and yet is reflected in increased productivity. The "spring flush" of milk production may not be so much the fault of the caretaker for being a poor winter feeder as of the biologist for being unable to determine what succulence is, and of the agronomists and animal husbandmen for failing to provide it more uniformly throughout the year. The whole subject of pasture management is of great importance as influencing the feeding value of pasture crops during the year.

The Louisiana Agricultural Experiment Station has made chemical analyses of 620 samples of pasture grasses at Baton Rouge, cut at monthly intervals during the past seven years. Early season samples contained more moisture and, on a dry matter basis, nearly twice as much crude protein as those cut in August or September. Crude fiber content increased markedly as the season advanced, as did calcium content. To a smaller extent, phosphorus content decreased with the advance of the season. Although recent work indicates that the more immature grasses of spring are more easily digested than mature grasses, the May, June and October samples appeared to have more nutrients per hundred pounds of grass than either very early or midsummer growth. This difference is due to change in rate of growth and consequent lower moisture content of the herbage. For example, a 1,000-lb. Jersey giving three gallons of milk would require 131 pounds March pasture, but only 89 pounds June or October grasses per day, if pasture grass formed the entire ration. Neither ration

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would be deficient in digestible protein, and the March pasture actually would furnish 74 per cent more than is needed by the cow. It is assumed that the quality of the protein furnished by this mixed pasture is quite complete and adequate for normal nutrition. This might not be true of all pastures or of any one pasture at all seasons of the year. According to recent investigations by the Bureau of Dairy Industry of the United States Department of Agriculture, it is possible for a cow to consume and digest 100 lbs. palatable grass every 24 hours. The larger weight of March pasture, being more palatable, would be consumed as readily as 80 to 90 lbs. midsummer pasture if the two were equally available.

Considering the average composition of this pasture for the entire seven years, a 1,000-lb. cow would require 46.3 lbs. grass for maintenance and 19.4 lbs. for each gallon of 5.3 per cent (Jersey) milk. Thus, the nonproductive animal or the lower producing cow could subsist entirely on pasture, but a five-gallon cow would not always be able to consume the required 144 lbs. of grass daily. This grass is a "watered" 16 per cent protein feed," balanced in the usual sense, but too bulky to serve as the only feed for high producing cows, work stock, fattening hogs, or poultry.

A more serious objection than bulkiness of pasture grasses is the irregularity of production, dependent as they are on rainfall, temperature, soil fertility, and such factors. An attempt was made to measure the per acre production of the above pasture by means of cages. The average yearly green weight per acre of all areas was 39,023 lbs., with a range of from 30,000 lbs. the poorest year to 49,979 lbs. in 1931, a good growing year. The average amount of grass produced per day per acre was 151.3 lbs. However, the average rate of growth was 234 lbs. in April, 153 lbs. in June, and only 105 lbs. for the period ending in October. There were peaks of grass production in April and August each normal year. April is also the peak milk production period for cows running on these pastures, but due to fall freshening, there is no secondary peak of milk production corresponding to grass production. High humidity and temperature undoubtedly hinder milk production, although these factors encourage grass growth in this coastal section.

There is other evidence, however, that the late season pasture is not as productive as that of early spring. Rapidly growing vegetation is more productive than slow growth. The problem of pasture management is to induce

an even, rapid growth for as much of the season as possible.

One other observation made in this experiment was that samples of grass (or legumes) representing the same growth period were quite similar in chemical analysis, regardless of genera or fertilizer. That is, rye grass or oats had about the same protein content and other analyses as white clover, when cut in the same immature stage of 30 days' growth. The fertilizer applications on this rich soil apparently did not effect the composition of the grasses.

The preceding results were obtained on alluvial land of the Sharkey series. When pasture grass samples were taken at Lafayette, on prairie soil of the Lintonia series, at 60 to 70-day intervals, the seasonal difference in composition between the first and last cutting samples was even more marked. Pasture vegetation responded quickly to applications of nitrogen and phosphorus and more slowly to lime and potash. This response was manifested by greater growth, rather than by any marked effect on the composition of the grass, with the exception of phosphorus content. The cuttings from the phosphate treated plots were higher in all but one case than those from the corresponding untreated plots. This difference was even more marked in similar trials at the Calhoun (hill) and Hammond (flatwoods) stations. At the latter station, increases in phosporus content of as much as 58 per cent resulted from the use of phosphate fertilizer, but very little difference in protein or calcium content was noted. Many samples of pasture vegetation have been taken from various soil types of the state. On the poorest, acid soils in late summer the protein content has been about one-half and the phosphorus and calcium contents about one-third of those of similar vegetation grown on alluvial land. We have calculated that about 40 lbs. of air-dried hay made from these poor pastures would be necessary to furnish sufficient protein, and 60 to 75 lbs. to furnish sufficient calcium and phosphorus for a one-gallon cow. Perhaps this is one fundamental reason for the existence of so many low producing milk and beef cattle herds on our cutover piney woods lands. Animals that do not receive supplementary feed cannot eat enough grass or its hay to have a complete ration.

These results and observations from Louisiana are applicable to all parts of the South except the extreme western and middle sections. More complete results have been obtained in some states, particularly South Carolina, Florida, Alabama, and Tennessee. The chief point that I wish to

make in regard to the feeding value of pastures is that because of the tremendous variation due to soil fertility and seasonal influence, we cannot merely plant adapted varieties of grasses and legumes and have pastures of complete feeding value. I believe it was Dean Cooper, of South Carolina, who pointed out that over 40% of the soils of his state were too acid to grow the necessary legumes for pastures or supplementary hay crops. A large proportion of soils of this state, as well as of other states, need one to two tons of lime and 200 lbs. of 18 per cent superphosphate or their equivalents to grow even the better pasture plants. Yet, under the Soil Conservation program, it is these less productive soils that are retired from cash crop production, terraced if necessary, seeded, and expected to produce feed for our increasing livestock population. More feed crops are being produced, but it is quite questionable whether these crops are of a quality to make for good production. Livestock people generally recognize this question and will have to emphasize even more the importance of supplementary mineral matter, protein in fall and winter, and feeds of known value when these new pasture lands and hay crops are being used. Mowing for weed control, earlier cutting of hay crops to get better feeding values, manure distribution, cultivation for insect and parasite control, and moderate fertilizer application when the prices of animal products justify it, must be practiced, in addition to feeding the above supplements. Any of these practices will influence returns from livestock products.

The animal husbandman still feels that the kinds of pasture plants, with the exception of poisonous or unpalatable ones, are not so important if they are productive and if they interlap to form a long grazing season. That is, more progress may be made by following good cultural practices with some of the grasses than by searching for legumes to grow on poor land. In general, our pasture soils are more deficient in phosphorus than in nitrogen. It may be more economical to add phosphorus and a little nitrogen to grow legumes before planting legumes to restore nitrogen to the soil. Broadly speaking, a rapidly growing grass that will withstand grazing and tramping will furnish as much feed as any legume. As pointed out earlier, we are not as much interested in obtaining more protein in good pastures as in obtaining the greatest total supply of succulent feed.

Fashion Says Fur

Condensed from New England Homestead

WITH fashions popularizing three types of fur, all coming from the same source, Karakul sheep, the United States Department of Agriculture through its Bureau of Animal Industry and Bureau of Biological Survey is deeply interested in breeding experiments which may mean that ultimately American farmers can produce the fur for which the American fur trade paid more than $2,000,000 in 1935, and more than $3,000,000 in the past five years.

The three types of fur, all popular in the clothing trade, are broadtail, Persian lamb, and caracul. The three general types are different in appearance and have a wide quality range.

Of the three, broadtail is the most valuable. The production, however, is small compared to the other two types. It is produced usually from prematurely-born lambs and is a flat, lightweight, lustrous fur with a water-wave pattern. Despite its higher price, broadtail is the least durable of the three.

Next in value is the "Persian lamb." This type of fur comes from Karakul lambs three to ten days old. It has a tight, lustrous curl that must be watched carefully from the time the lambs are born. The curl is likely to open rapidly after the fifth day, and while the value increases with the size of the pelt, it is essential that the curl remain tight.

Caracul is merely a trade name given to the lustrous, open type of fur which shows a wavy moire pattern free from close curls. These skins are usually light in weight and are best if removed when the lambs are not more than two weeks old, although this type pelt does not deteriorate so rapidly as the lambs grow as either the broadtail or Persian lamb types.

There are a number of reasons why American farmers cannot produce enough for domestic demand: There is only a small number of pure bred Karacul sheep in this country. The basis for this stock came from small importations from Bokhara, Central Asia, native home of the Karakul, in 1909, 1913, and 1914. Further importations of animals of this breed are next to impossible because United States animal quarantine regulations prohibit direct importation from their native country and indirect

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importations, after being held for the required length of time in another country, are too expensive.

Facing this situation the two Bureaus of the Department have been co-operating in a breeding program which promises good results. Realizing the near impossibility of increasing the breed to any appreciable extent from present stocks of pure bred animals now in the country, the Department has been carrying on a cross-breeding experiment at the National Agricultural Research Center at Beltsville, Md.

In this experiment pure bred Karakul rams were crossed with Blackface Highland and Corriedale ewes. Blackface Highland Sheep came originally from Scotland and the Corriedale from New Zealand.

Ewes produced from the crosses were bred back to pure bred Karakul rams until last year when several lambs from four top crosses were available for fur study. The entire lamb crop, including crosses, as well as purebreds, last year was used in a fur study by the Bureau of Biological Survey. Both the ewe and the ram lambs were pelted, whereas in the past only the ram lambs were used in the fur tests. Fur specialists of the Department have found that the lambs from the fourth-top crosses grade comparatively high in quality and are readily marketable through the regular fur trade channels.

On the basis of quotations last fall, the following values were placed on the pelts:

Average price for Karakul-Blackface Highland crosses: 10 pelts from second-top cross, $3.03; eight pelts from third-top cross, $3.38; two pelts from fourth-top cross, $5.62; one pelt from fifth-top cross, $5.83.

Average price for Karakul-Corriedale crosses: three pelts from first cross, 72 cents; three pelts from second-top cross, $3.47; nine pelts from third-top cross, $3.33; five pelts from fourth-top cross, $3.33.

Average price for 29 pure bred Karakul pelts, $4.26.

These prices were set on the raw pelts by three disinterested furriers on the New York fur market. The figures show that pelts from the second-top crosses and up compare favorably with the pure bred Karakul produced at the Research Center.

Karakul sheep are noted for their hardiness and ability to thrive under adverse conditions. The mature animal develops a lustrous but coarse wool which is used in the manufacture of rugs, carpets, blankets and robes. Because of its limited uses the wool from the Karakul usually sells from one-half to three-fourths the price paid for good-quality white wool.

This breed has not been developed as a meat-producing animal although the meat is wholesome and can be marketed.

The only drawback to commercial production, the fur specialists say, is in the variability of the market. Such fur may be in fashion one year—out the next. Nevertheless, off years may be utilized in breeding up the flocks for the better marketing years. Meanwhile, sale of wool and wether lambs possibly would take care of expense in maintaining the flock.

Soviet Russia leads the world in Karakul-fur production, with southwest Africa, second, and Rumania, third.

Importations from Russia of lamb, sheep, kid, and goat skins, of which a large proportion were Karakul skins, as given by the Department of Commerce, are as follows:

1931—16,008 pieces valued at $89,855
1932—924 pieces valued at $4,164
1933—79,676 pieces valued at $333,697
1934—101,036 pieces valued at $663,373
1935—263,527 pieces valued at $2,001,185

No figures are available on the production of Karakul fur in the United States, but it is known to be small. In the three importations of Karakul sheep from Bokhara only 34 rams and 33 ewes were shipped to this country. The larger part of the present domestic supplies have come from this source.

Cross, Crisscross and Backcross

Condensed from Breeder's Gazette

L. M. Winters
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FOR many years farmers have recognized that crossbred animals have distinct advantages for market purposes over purebreds or high-grades. Western sheepmen produce crossbred lambs regularly, and cornbelt farmers crossbred swine. It has become widely accepted that the crossing of two breeds is of distinct advantage in producing commercial animals, but that it is ruinous to use crossbreds, themselves, for breeding. In the face of this general view, some good farmers have kept crossbred sows for breeding, without disaster. Science gives us reasons for believing that if crossbreds make better market animals, the crossbred females should make superior mothers. Sows carry their pigs about 112 days before birth, and nurse them about 56 days after birth. Therefore, for 168 days pigs are mainly dependent upon their mothers. It appears, then, that anything which materially improves the sow in vigor should benefit her pigs.

In order to obtain definite information regarding the merits of crossbreeding, the Minnesota Experiment Station began a long-time study of crossbreeding in the fall of 1928. Objects: 1. What advantages, if any, may a farmer expect as the result of crossing two or more breeds of swine? 2. Should all the crossbred gilts be marketed or can they be used to advantage for further breeding? 3. If the crossbred sows are better mothers, how can they be used to advantage for further breeding?

Three types of crosses were made: 1. First-cross, by mating sows of one breed to a boar of another breed. 2. Three-breed-cross, by mating first-cross females to a boar of a third breed. 3. Back-cross, by mating first-cross females to a boar of one of the breeds used in making the first cross. The same bloodlines were used in producing the crossbreds as the purebreds. At the outset, the sows used for crossing and pure breeding were of the same type and breeding. The same boars sired purebred and cross-bred pigs. During the first

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8 years 1,535 pigs were farrowed under this experiment. At this time over 1,800 pigs have been farrowed.

The farrowing results are almost wholly in favor of the crossbred groups. The back-cross did not average quite as high as the purebreds, but the first-cross averaged one pig more and the three-breed-cross 1½ pigs more. In total litter weight, which is a combined measure of number and weight per pig, the advantage was distinctly in favor of all three groups of crossbreds.

The three types of crosses maintained their advantages through the nursing period of 56 days. More pigs were weaned per sow in the crossbred groups than in the purebred. The advantage in total litter weight, the best summation of merit, was 39 pounds over the purebred by the first-cross litters; 63 pounds over the purebred by the back-cross; and 96 pounds by the three-breed-cross.

It is very clear from the experiment that the crossbred sows are good mothers. The pigs out of crossbred sows outdistanced both the purebred and the crossbred pigs. Furthermore, the crossbred sows had large udders, and quiet dispositions, and were easily handled.

From weaning time on, the three types of crossbred swine continued to grow faster than the purebreds. The first-cross and three-breed-cross pigs reached a weight of 220 pounds 17 days earlier than the purebreds, and the back-cross pigs reached that weight 22 days earlier than the purebreds. That means that the farmer producing crossbred, market hogs can cut off from two to three weeks of bad weather in either the spring or the fall, a very important economic advantage. In economy of gains the crossbreds possessed a slight advantage over the purebreds. The advantages in economy of feed, per 220-pound pig, amounted to ½ bushel of corn per pig for the first-cross and back-cross groups, and 2/3 of a bushel for the three-breed-cross.

Since the close of the first six years' study of crossbreeding, we have confined our crossing to a study of the effect of continuous crisscrossing—the alternate use of boars of two breeds. The third generation of crisscross pigs was produced last year, continuing to maintain the advantages of the first-cross and back-cross pigs given above.

Successful farmers have also used crossbred females with satisfactory results. Andrews Bros., Steele Co., Minn., started crisscrossing between the Tamworth and Duroc-Jersey breeds in 1929. After 7 years they are thoroughly satisfied that they have obtained better results than if they had

graded their herd to either one of the breeds used.

The results obtained from our experiments and from observation of two good sound farmers' herds have made it clear that for market hog production the three types of crossbreds produced are superior to purebreds of comparable bloodlines; that crossbred sows excel the purebreds as mothers, whether mated to a boar of a third breed or back to one of the breeds that entered into her breeding; and that there is as much additional benefit from keeping the crossbred sows for breeding as in making the original cross.

Two methods are open to the farmer wishing to practice continuous crossbreeding. The first is to alternate in the use of boars from two breeds, crisscross breeding. Mate a high-grade or purebred sow to a purebred boar of another breed. Keep the best gilts and mate to a purebred boar of the first breed. Then alternate with boars of the two breeds. The second method is to mate the first-cross females to a boar of a third breed, and then rotate in the use of purebred boars of the three breeds. With this method it is well to confine crossing to three breeds. The disadvantage of using three or more breeds is that the later generations are likely to possess a greater variability in color.

Crossbred boars should not be used as sires because: 1. Mating a crossbred male to females of the same cross will result in offspring with too much variability in type and performance. 2. One of the parents must be purebred in order to stabilize the system, and keep the crossing continuous. One good purebred boar can be purchased cheaper than a group of purebred females. 3. Pigs benefit directly from the increased vigor of the crossbred sow for 112 days before birth and 56 days after, but could not benefit in any such manner from the increased vigor of a crossbred male parent. The purebred sire is the basis for the improvement of swine or any other class of commercial livestock. Crossbreeding will not solve any difficulties or contribute anything to constructive pork production, unless good purebred sires are used. The purebred breeder has nothing to fear from the proposed methods of breeding swine. In fact, he has much to gain. Many farmers are still using grade sires. Farmers who follow one of the methods of crossbreeding outlined here will utilize purbred sires in the practice; hence an increased demand for purebred sires should follow.

Soil Management and Drouth

Condensed from Wallaces' Farmer

C. D. Kirkpatrick

Iowa

THO I hope it will be years before we have another crop season like 1936, the extreme heat and drouth was an opportunity to learn a lot about what is good and bad in management of soil for corn. Many details of farm practice which seem comparatively unimportant under normal conditions become essentials at such a time.

In 1936, the weather seemed to be the limiting factor, yet there were wide variations in the crop yields under the same weather conditions. Differences in the quality of plant growth indicated that soil conditions were partly responsible. Corn on a field of 18.5 acres north of the farmstead here at Walden Farm illustrated the benefits possible from soil management.

I have the annual crop records of this field, which were begun twenty-five years ago. It was in blue grass then, and had been used for horse pasture. Beginning in 1914, it was made a part of a regular four-year crop rotation of corn, corn, oats and clover. During the first two rotations, the four corn crops on the field averaged about 58 bushels per acre.

In 1925, the field was given eight tons of finely ground rock phosphate and in 1929, four more tons. This amounted to about two-thirds of a ton per acre. In 1926, it was given thirty-five tons of rather coarse lime and in 1929 twenty tons more of better grade lime. This quantity of lime did not make the soil neutral, but it was enough to suit alfalfa and sweet clover. In 1931 and 1932, the corn yield averaged 77 bushels per acre an increase over the first two rotations of 32 per cent.

Sown with the oats in 1933 was a seed mixture of alfalfa, sweet clover, red clover and timothy. This was left for pasture during 1934, and, because of the drouth, also was used for pasture in 1935. In the fall of 1935, manure was applied at the rate of two loads per acre. On April 29 and 30, 1936, the field was plowed. This late plowing was a disadvantage, but the entire farm could not be plowed at exactly the best time.

Directly after plowing, the ground was double disked both ways with a horse drawn disc,

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and later double disked both ways with a tractor-drawn tandem. A spike-tooth harrow finished the seed-bed. Planting was done May 16 and 18 at a hill spacing of 38 inches each way. Ordinarily, the middle of May would have been the best time for planting, tho the last end of the month had an advantage last year. A cultipacker followed the planter, and, as usual, cultivation was twice over with a single row cultivator.

The corn plants (of a hybrid strain) did not attract the attention of casual observers during the first forty days after germination. In fact, they stood a little shorter than corn which had received soluble fertilizer. At this seedling stage, any corn receiving an excess of nitrates in the soil would have resulted in larger volume of growth, but a lower ratio of firm tissue. This fact has a bearing on how the 18.5-acre field finally turned.

Similarly, a deficiency of calcium or phosphate tends to result in soft tissues. Under certain soil conditions, an excess of sodium or potassium also has the effect of producting watery stalks. Contestants in yield tests have often ruined their chances for a good crop by over-stimulating their plants in June. Then, when the hot days of July lowered the relative humidity, stalks with a high water content and soft cell walls quickly wilted.

In contrast, this corn on the 18.5-acre field was prepared to meet unfavorable conditions because it had developed essentially sound tissue. As the drouth became more severe and the temperatures climbed to new records, the soil appeared to be dry down 36 inches, but the roots continued to function in the zone between 40 and 60 inches below the surface. Fortunately, plant roots in former years had been encouraged to penetrate into these lower levels, so there was some organic matter and a favorable physical condition down below the abnormally hot surface. Crop rotations, manure, lime, rock phosphate, good seed and careful tillage had been the program for a long enough time to make that margin of difference between profit and loss.

Then came the days when a cactus with a hide of leather could scarcely endure the sun. Nevertheless, this corn continued to carry on. The stalks never attained a normal height and the ears were small, but the close planting seemed not to be a handicap.

In spite of a bad season, this field made more than 60 bushels per acre, or 2.8 bushels per acre more than the average of the four corn crops in the two rotations after 1914.

Trichomonad

Cattleman's Enemy

Condensed from Successful Farming

Justin Andrews
Johns Hopkins University

FOR the past ten years veterinary scientists in Central Europe have been interested in an infectious cattle disease which terminates in abortion, uterine abscess, and other reproductive defects. The date of its introduction into the United States is not known, but the presence of the germ causing this disease was first noted in this country in 1932. Since then it has been reported from 14 different States so that the distribution, tho imperfectly known, appears to be country-wide. In herds where the infection becomes established, reproductive abilities of bulls, cows, and heifers are markedly reduced.

Trichomonad disease is entirely unrelated to the well-known Bang's infection. Bang's disease is caused by a vegetable-like germ, trichomonad disease by an animal-like germ. Both can cause abortion. Trichomonad abortion may occur in a Bang's positive cow or it may not; similiarly, Bang's infection may be active in a cow harboring the trichomonad organisms or in a cow which is free from them.

Trichomonad disease shows itself in a variety of ways in heifers, cows, and bulls. Whether or not there may exist different strains of trichomonads capable of producing mild or severe manifestations is not known. Certainly it appears that cattle vary in their resistance to the germ. During her first mating with an infected bull, a heifer may or may not contract the infection, altho the former possibility is more likely. Once infected she may show slight symptoms for only a few days, or she may go on to an unmistakable, acute, inflammatory course leading to delayed conception, sterility, abortion, or uterine abscess. Natural or spontaneous cure may take place at any time but occurs more frequently during the earlier stages of the process.

The characteristic signs of trichomonad disease ordinarily appear in heifers and cows within a week after the infection is acquired. The first of these is a

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swelling of the parts immediately surrounding the sexual opening. A few days later a discharge of mucus appears. At first it is clear, then cloudy, and later pussy or even bloody. It soils the tail region, causing the hairs to stick together. This may continue for several weeks, or it may come and go over the same period of time. The animal rarely shows more than slight, uncertain rises in temperature but may low considerably, give signs of pain and distress in the affected parts, and refuse food temporarily. Frequently the discharge appears to stop by itself, giving the impression that the heifer is cured. In an occasional instance she does seem to have thrown off the infection and may conceive successfuly thereafter, or, if already pregnant, calve normally. More frequently, however, her relief is only temporary, and, in the course of time, she either aborts or develops a uterine abscess.

If she continues to come in heat, the intervening periods may be very irregular, being abnormally shortened in some instances and lengthened in others. As long as the discharge continues and for a few weeks thereafter, such a heifer usually fails to catch in spite of repeated matings with a good bull. Sometimes after the discharge has ceased, she may conceive and proceed to a normal or abortive pregnancy. We have repeatedly seen infected heifers fail to settle from their first five or six services and then, as the discharge subsides, become pregnant from one of the next half-dozen breedings. However, in some instances the animals remain persistently and, from a practical standpoint, permanently sterile. From this account it is evident that many of the commonly observed instances of delayed conception and sterility of heifers and cows may be due to trichomonad infection.

Heifers sometimes become pregnant from the same breeding which infects them, or from subsequent matings. As indicated above, the discharge may continue but frequently stops, and the animal appears healthy until she calves, aborts, or develops an abscess in her womb. Some infected animals never show any sign of this acute inflammatory stage. Abortion usually occurs during the first five months of pregnancy; rarely, later. The expelled calf may be almost unrecognizable, being partially liquified, gelatinous, and disintegrated, or it may be normal in appearance. If the afterbirth comes away cleanly the heifer ordinarily recovers promptly, will come in heat, settle, calve, and freshen normally.

Instead of aborting, the dead calf may be held within the uterus where, by a combined pro-

cess of inflammation of the organ and decay of the dead calf, an abscess may not drain at once but increases in size so that the heifer still appears to be advancing in pregnancy. Eventually the natural channel opens up spontaneously, the heifer goes by her expected calving date, or, from manual examination, is suspected by a veterinarian of having an abscess instead of a living calf within her. In any event, whether the opening of this abscess occurs naturally or as the result of operation, considerable quantities of thin, puslike contents come out. These may be watery or grayish in appearance but are commonly milky or creamy and contain curdlike shreds of yellowish or blood-tinged mucus and clotted pus which settle out on standing. This is typically without a foul odor in cases where the trichomonads are the only invading organisms. Such a condition may have grave consequences and demands prompt attention. The services of a skilled veterinarian offer the greatest likelihood of saving the animal with the possibility of future breeding. If the process goes on unchecked it may lead to serious internal disturbances that threaten the life of the heifer or the destruction of her internal reproductive organs.

The development of symptoms identical with those described before may occur in susceptible cows as well as in heifers. This usually means cows which have not been infected previously, as infection seems to develop some degree of resistance. Regarding the nature, effectiveness, and duration of this resistance, little is known. Judging from occasional infections in old cows, the resistance does break down at times. Thus, in *infected* herds, the disease is usually acquired by the female stock, as heifers, in which it is epidemic. In the cows in the same herd it appears sporadically if at all. In *clean* herds, the disease once introduced is epidemic in cows and heifers thruout the next breeding cycle, after which it remains epidemic in heifers and becomes sporadic in cows.

Bulls usually show definite symptoms for a short time after they become infected. The open end of the sheath becomes swollen. A mucous or puslike discharge leaks out and dries so that the bristles and hairs at the end of the sheath stick together. Urination appears to be painful. The end of the bull's penis becomes intensely inflamed, swollen, and covered with white blisters. The act of breeding is painful and the bull frequently shows no desire to mount. This acute stage usually subsides within a few weeks. Gradually the bull returns to normal physical condition and sexual desire, but unless effective treatment has been instituted

during the inflammatory stage, he continues to carry the causative organisms and to discharge them with the semen. Bulls have been known to remain infected for at least eight months without service. Probably this chronic carrier condition persists indefinitely.

As in the case of other venereal infections, trichomonad disease seems to be occasionally, tho rarely, transmitted in nature without sexual contact. Infections have been observed in heifers which had not been bred but which had been quartered with other infected heifers and cows. Transmission in such cases may have been the result of accidental contamination with the infectious discharge.

Causative organisms have been shown to remain alive in bovine saliva and urine up to 10 hours, and in water for from four to nine hours. They cannot survive complete drying or pasteurizing temperatures but are not killed by freezing, even for 24 hours. They are readily susceptible to disinfectant solutions. As far as is known, they must enter the body thru sexual openings in order to produce infections; that is, they are non-infective when taken in with food, drink, or air.

As pointed out above, trichomonad disease may cure itself. Unfortunately this natural process occurs in only a small percentage of cases and therefore cannot be depended upon. The treatment of sick animals requires technical knowledge and skill and should be attempted only by experienced veterinarians. It consists of repeated irrigation of the infected organs with iodine—orchlorine—containing disinfectants, complete evacuation of the uterus, and temporary retirement from breeding. The determination that a treated animal is not only healthy but is free from organisms is very difficult.

For all practicable purposes, healthy bulls which have passed thru the acute stage without proper treatment and which are known to harbor the germs may be considered incurable. If the owner aims to maintain a clean herd, such animals must be disposed of until some dependable treatment is found. The most important control measure is to keep the bull free from infection. It is very risky for the owner of a valuable bull to permit him to serve strange cows without determining by history, physical examination, and microscopical examination that the animal to be served is free from trichomonad disease. Where this information cannot be obtained, it is safer to resort to artificial insemination thus avoiding the exposure of the bull to possible infection from the cow.

Trichomonad disease does not affect the edibility of bovine flesh.

Sick cows and heifers should be treated by a veterinarian and kept isolated from the other stock until cured and rested. Successful cure should be judged by physical examination of specimens taken by the veterinarian. Animals should be rested for at least eight weeks after they are apparently free from the disease and the causative organism.

Finally, it is to be strongly emphasized that knowledge concerning the importance, appearance, treatment, and the control of the disease in this country is sketchy and in the making. It is being studied by Government scientists and by investigators at state colleges, experiment stations, and at private institutions. An effective and practical understanding of the disease will in the last analysis depend to a great extent upon the co-operation of cattle-owners. For the common good, it is to be hoped that they will encourage and support in every possible way the search for more complete information about this dreaded trichomonad disease.

Why Floods?

Condensed from The Nation's Agriculture

John M. Kennedy
U. S. Department of Agriculture

FLOODS have once again brought death and destruction to the Ohio River Valley. Last year the New England states were among those most ravaged by raging river waters. In 1927, the region along the Mississippi suffered the greatest over-flow in its whole recorded history when the waters broke through the levees at more than 200 places, causing considerable loss of life and damage of several hundred millions of dollars. Whose turn will it be next?

Some say it is inevitable, adding that there were floods on this continent long before man settled it and that there will continue to be floods regardless of his efforts to stop them. Defeatists will point out that we have spent incalculable sums on flood control and still the waters continue their destructive rampage. Levees, reservoirs, spillways, dams, diversion channels, and other engineering projects have been built but rivers continue to break their bonds.

Why is it, that after so many years and after the expenditure of millions and millions of dollars, great cities like Pittsburgh, Cincinnati, Louisville, and agricultural communities along the rivers, must continue to undergo such tremendous suffering?

The principle reasons would appear to be twofold. One is the fact that the flood problem is at least partially an agricultural one. Second, efforts to solve the problem have been limited in scope, with the principle reliance placed almost entirely on downstream engineering work. We have not had a program sufficiently comprehensive on a nation-wide basis, beginning at the point in the hills where the raindrop and the snowflake hit the ground and ending where the water runs into the sea.

Flood control starts as an agricultural problem because it is on the farm, pastures, meadows, and woods of the watersheds or catchment areas that most of the rain and melted snow begin their march to the sea. If the lands of these basins are in such a condition as to absorb most of the water falling on them, the sea-

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ward movement will normally be a slow one. But if the lands have been stripped of their trees and grasses, overcropped and overgrazed, and allowed to become eroded, the waters will have less to hold them and in periods of intense rainfall or rapidly melting heavy snows, they will rush over the land into the creeks and rivers, forming destructive floods.

Data of the Soil Conservation Service of the Department of Agriculture offer ample proof of the efficacy of vegetation in retarding the runoff of water. Their reports show that during September, 1936, two record rains, one day apart, fell on the soil and water conservation project along the Concho River, a tributary of the Colorado River of Texas. The Colorado River went on a rampage of terrific disturbances, but on 8,000 acres of the Concho watershed the conservation work held every drop of water that fell on the land, and no soil whatever was lost. More than 8,000 acre-feet of water that otherwise would have run off, was stored in the soil and thus kept out of the Concho River at a critical time.

The forest cover on 5,000 acres in Pickens Canyon in California was burned off by fire in 1933. The forest of neighboring San Dimas Canyon remained unburned. Toward the end of December,1933, both canyons were struck by a violent storm, and on New Year's Day, 1934, a flood swept out of Pickens Canyon, destroyed 200 homes and killed 34 persons. No flood affected the unburned San Dimas Canyon, because the forest cover held the water back and fed it slowly into the streams.

Data gathered by the Soil Conservation Service from experimental plots in the watershed of the Muskingum River, a major tributary of the Ohio, show that during the present flood, approximately *four times* more water *ran off cornfields* than off grassland or woodland. Prior to the present storm period, a two-year experiment in the same locality showed that less than four per cent of the total annual precipitation was lost as surface runoff under a cover of timothy. The same kind of land planted to corn lost 35 per cent of the rainfall as surface runoff, along with 60 tons of soil per acre per year.

Our record of land management in the United States has been a bad one. We have acted as though there were no limit to Nature's bounty. Lands once rich in topsoil and plant nutrients have been so abused that these essentials for healthy national growth have in many sections been irretrievably lost. These are the losses that do not make the headlines when rampaging waters burst on communities. We read of deaths from drowning

and disease and of ruined homes and factories and farms, but the tremendous losses of soils and plant foods to future generations are not emphasized. The Soil Conservation Service has estimated that during the current flood, the lands in the Ohio Drainage Basin have lost more than 300 million tons of soil.

The loss of this soil is only one part of the enormous damage of erosion. Much of the wasted soil is helping to reduce the carrying capacity of the rivers and the storage capacity of the reservoirs into which it has washed, thus raising the crest of present and future floods. Some of this debris of erosion is dropped by the raging waters on farm land further downstream, where it covers and ruins fertile farm land. Some of it is carried out to sea. In normal years, erosion takes 300 million tons of soil from the Mississippi Valley alone, and dumps it into the Gulf of Mexico. The Mississippi delta itself is growing at the average rate of 330 feet a year. In the effort to prevent their standard of living from sinking too low in time of depression, and inspired by high prices in boom times, farmers had been driven to over-cropping and over-grazing their good lands, and to clearing and plowing up those unfit for cultivation. The result was that many lands were deprived of natural vegetation and of the forest litter which not only absorbed the water falling on them, but which kept much of the ground from becoming frozen. Therefore, when the crop adjustment programs, with the primary purpose of establishing a balance between production and market requirements, enabled farmers in all parts of the country to plant less intensively to cultivated crops and urged them to replace these crops with legumes, grasses, and trees, which not only protect and build the soil, but retard the runoff of water and thus reduce the strength and volume of floods, the nation took a remarkable step in the direction of flood control. The agricultural conservation programs which succeeded the crop control measures are bringing us even faster toward such a goal.

There are skeptics who have little faith in the effective control of head-waters through reforestation, cultural changes and generally wiser land managements. Their faith is placed almost entirely in engineering works. Yet experience has shown that though levees or concrete walls alone may be effective one year, in a few years, sometimes only a year later, water may overtop them, frequently because the silt-filled rivers bordering them are able to handle less water than formerly. But while such persons are right in their insistence on the need

for engineering projects, they are wrong when they overlook the importance of controlling water at its source.

When the Mississippi Valley Committee, now the Water Planning Committee of the National Resources Board, submitted its report in October, 1924, it said, in part: "A drainage basin, big or little, is a region through which water moves. No act of man can permanently halt this flow of power, nor even diminish it to an appreciable degree. The water must come down—we could not stop it if we would. We can, however, canalize it so that it will do what we want it to do and not do what we do not want it to do."

Canalization should begin the minute the water hits the ground. It is to the interest of the farmer that he slow down the departure of water. He must hold on to his most valuable asset, his fertile top-soil, if he does not wish eventually to go bankrupt. He can do this through proper land management. This includes regrassing and reforestation of land unfit for cultivation, forest protection, controlled grazing, and the widespread protection of cultivated land with strip cropping, contour cultivation, terracing, crop rotations, and other adaptable measures for holding soil and water.

Uniform state laws and federal legislation are needed, permitting interstate agreements for flood control as well as a comprehensive plan of procedure developed co-operatively by federal, state and other interests.

A national flood control program could do much to insure the prosperity and happiness of our people. At the same time that it reduced the volume and velocity of runoff water from the land and thus decreased the danger of disastrous floods, it would save the top-soil; alleviate drought conditions; protect well-water; permit better irrigation; conserve wild life; reduce the pollution of water; prevent the silting-up of reservoirs, dams, and rivers; provide a source of power; improve navigation on inland waters; help stabilize property values; provide additional recreational facilities; and confer other benefits too numerous to mention. There are few sections of the country that would not experience one or more of these important benefits, and ultimately every citizen would realize that the money spent on such a program is less of a burden to the nation than the tremendous sums it is now being called upon to pay every year to repair the appalling damages resulting from unco-ordinated flood control.

New Breeding Developments

Condensed from The Leghorn World

H. M. Scott

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IN its early stages of development, the breeding of poultry was confined to perfection of appearance and so long as body conformation and color were the only requirements, there was little need for the trapnest. With the introduction of the trapnest and the pedigree work associated with it, the breeding of poultry today has become highly complex. The trapnest opened many fertile fields of approach and some of the best trained men in the world are now working in this particular phase of animal breeding.

There are some who will condemn the trapnest on the assumption that the trapnest and it alone is responsible for all the ailments afflicting the poultry of today. It is probably true that many of the problems that are confronting the industry at the present time would never have arisen had the trapnest not appeared. At least the problems would not be so acute as they are, for without the production breeder, the poultry industry as we know it now, would not be in existence. The point in question is this: In an absolute sense, our problems are greater than they would have been without the trapnest. On a relative basis, it is doubtful that such problems as mortality are any greater today than they were some 30 years ago.

The poultry industry is an integral part of the greater agricultural industry. The farmer with a flock of 200 hens is not maintaining this flock as a hobby. His interest in this flock is purely a question of dollars and cents. He knows, and we all know, that eggs and poultry must compete with other food products for the consumer's dollar.

We hear much of the word "over production" and the question arises, "Should we attempt to incorporate in the breeding program those factors which will make it possible to produce two eggs where but one egg was produced before?" The answer is, of course, obvious. If the breeders of poultry do not advance in this direction, the hog breeders, the cattle breeders, and the

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cereal crop breeders will. If these last mentioned groups can produce more economically than we can, the consumer of farm products will spend less of his income for poultry and eggs.

The poultry breeder must focus his attention primarily upon those factors that will, in the end, enable the farmer to produce poultry and eggs with a greater degree of economy.

We should not expect the impossible from the poultry breeder. It takes time, effort, and money to fix a desirable trait in a strain of chickens. Each time the breeder adds another factor to the list that he is attempting to fix in his strain, he reduces the number of individuals that will possess all of them.

Suppose the poultry breeder attempts to fix a single dominant character in his strain. If this character is inherited in a simple manner and if the character is heterozygous in the stock that he has to work with, three out of every four offspring will possess the character that is desired. If a second factor is added to the list, 9 out of 16 will possess the two factors and when three factors are involved, 27 out of 64 will have all three. The point in question is simply this, each time the breeder adds another factor to the long list with which he is already working, he reduces the number of progeny that will possess all of these traits.

Unfortunately, not all of the desirable characters are inherited in a simple manner, nor are they dominant, and this fact further complicates the breeding program. Certain it is, if the breeder desires to increase the complexity of his breeding program, any factors that are added should have some economic background.

To date, the utility breeder has focused his attention on two factors. These factors are first, number of eggs, and second, size of egg. Egg production has been stressed for the past 30 years. We think and live in terms of eggs per hen and, it must be admitted, sometimes to our own detriment. Egg production is conditioned by a number of genetic factors such as early maturity, non-broodiness, persistency, and intensity. Its inheritance is highly complex and while many splendid individuals have been produced, it must be admitted that the increase in egg production of the general farm flock has been slow and even disappointing. The record of an individual hen has been overemphasized, while the family record has been ignored. Not until the breeder launches into some well outlined system of progeny testing can we expect to materially improve the production of the birds on the general farm.

Most breeders are making a

conscientious effort to perpetuate strains that will lay eggs of standard size.

While many breeders have been satisfied to work solely with egg production and egg size, some have reached the point where they are further complicating their breeding program by giving some attention to longevity and hatchability.

At the present time, we are hatching from thousands of females, which themselves are unable to survive the first laying year for one reason or another. The resulting progeny has little constitutional vigor. Possibly they have little resistance to some of the common poultry diseases, but in any event, the net result is high chick mortality, or if it does survive the chick and growing periods, high mortality in the laying house.

It is encouraging to note that some of the experiment stations have recently outlined projects to study the resistance of chickens to some of the common poultry diseases. I refer specifically to the work under way at the University of Illinois and Iowa State College. More encouraging still is the ever-increasing number of trapnest breeders who have incorporated the factor of longevity in their breeding operations.

As for hatchability, when the hatching records of a large number of females are examined for a given breeding season, the graduations were from 0 to 100 per cent with an average somewhere between 60 and 70 per cent. That hatchability is a heritable trait is well known and in spite of the extensive investigations that have been conducted along this line, we are far from knowing why one hen will give 0 per cent hatchability while in the same pen a second hen will have a perfect hatching record. The four factors that have been enumerated, namely, egg production, egg size, vigor, and hatchability, will keep the hands of the breeder from remaining idle for some time to come. There are, however, two other factors that are sorely in need of attention. The ground work for elimination of these two undesirable traits has been laid, and it is a question of applying the facts that have been demonstrated experimentally.

First, among these, is the question of skeletal deformities, notably the crooked keel. This undesirable trait has been tolerated for years. It materially affects the market grade of poultry. The produce buyers of Kansas as well as other states in the Midwest, have recently launched a three-grade buying program: Number 1 poultry, No. 2 poultry, and rejects. Crooked keels are classed as number two poultry, and justly so.

After many years of breeding,

Dr. Warren of the Kansas Station, has been able to demonstrate that there is a definite heritable tendency toward the crookel keel and has recently prepared a bulletin setting forth his findings. By careful breeding, he has been able to establish strains of leghorns that differ widely in their tendency toward crooked keel bones. Moreover, he has been able to show the inter-relationship of nutrition and such environmental conditions as time of roosting and sharpness of roosts to the expression of the deformity. The crooked keel strain, when provided with sharp roosts, developed about 80 per cent crooked keels while the straight keel strain when reared with the same roosts developed but few crooked keels. Either strain, the crooked keeled or the straight keeled strain, when reared without roosts, showed little or no evidence of the deformity. These experiments show definitely that the tendency toward the development of crooked keels is inherited.

The second factor in need of attention is that of feathering. One of the important quality factors in young stock is the condition of the body feathering when it is slaughtered. The "bare back" broiler is a problem. This condition has been responsible for the decline in popularity of some well-known heavy breeds. There is no reason why we cannot convert our slow feathering breeds into rapid feathering breeds. Its feasibility has been demonstrated experimentally, and some breeders have already made use of this fact and are today selling heavy breed chicks that feather out early in the same manner as Leghorns.

Unfortunately, slow feathering is a dominant character, but among most strains of heavy breeds it is possible to find a few early feathering individuals. Chicks having the sex-linked early feathering factor may be recognized by the presence of well-developed tail feathers when the chicks are ten days of age. By marking these early feathering chicks and using them as breeders, it is possible to convert the late feathering strain into an early feathering one. The fixation of the factor for straight keels and the factor for early feathering in the various breeds of poultry is very much worth while and is of greater importance to the industry than the elimination of down on the toes.

There are a number of other factors that we can at least meditate over. The first has to do with the internal quality of the egg. Not all freshly-laid eggs are good eggs when measured by our present standards of internal quality. As a matter of fact, some hens lay eggs of very poor internal quality. The California Experiment Sta-

tion has recently published data showing that this trait may also be a heritable one.

The question of fertility is the second point. Lacking evidence to the contrary we have assumed for years that fertility was not a heritable trait. Today we are not so certain that this is true. Recent work has been published which would indicate that heredity may be a contributing factor to poor fertility in the fowl.

With our larger farm animals as well as with the smaller laboratory animals, such as the rat, numerous investigations have been undertaken to study the efficiency with which they utilize food materials. Since these investigations have shown that these animals vary widely in this respect, there is every reason to believe that the same condition exists in poultry.

There are then, four points that every breeder should incorporate in the breeding program. They are:

1. Egg production.
2. Egg size.
3. Vigor.
4. Hatchability.

Two points that it would be very desirable to fix in the strain are:

1. The factor or factors responsible for straight keel.
2. Early feathering in the heavy breeds.

For the breeder of tomorrow, or those who think that they have reached the ultimate goal, let them be thinking of such points as:

1. Egg quality.
2. Fertility.
3. Feed utilization.

If the same assumption is made as was made earlier in the discussion with respect to the mode of inheritance and the genetic constitution of the birds, a mating involving all nine characters would result in approximately 7 per cent of the progeny having all nine of the desirable characters.

Fertilizing Vegetable Crops

Condensed from The Southern Planter

Dr. H. H. Zimmerley

Virginia Truck Experiment Station

IT is a common saying that truck farming is a gamble. In this post-depression period we vegetable growers realize that this is true and that we are holding low cards. We have statistics to prove this statement. The following percentage figures calculated from the farm value of crops, published in Crops and Markets, tell the story. The total farm value of the corn crop for the United States increased 171 per cent during the period of 1932 to 1936; that of the wheat crop 162 per cent; that of the tobacco crop 133 per cent; and the value of all crops, with the exception of fresh vegetables for market, increased 115 per cent. The value of fresh vegetables for market (not including canned vegetables, potatoes, or sweet potatoes) increased only thirty-seven per cent during the four-year period of 1932 to 1936, inclusive.

During this period the cost of material used in producing and marketing fresh vegetables increased tremendously. In most areas the increased costs have far exceeded the increased returns, leaving the growers at present in a worse position than in 1932, at the low point of the depression.

We hope that a brighter future awaits the vegetable grower, but until then he must "tighten his belt." It is a self-evident fact that until the price level rises the vegetable grower must effect certain economies if he expects to survive. What are some of the economies that should be practiced? Perhaps we can answer that question by asking another. What are the more expensive items in production where wasteful practices are likely to occur?

Most growers of vegetable crops throughout the Atlantic and Gulf Coastal Plain area will say, "We spend more for commercial fertilizers than any one other item up to the time the crop is ready for harvest." Most of the vegetable crops grown on the sandy soils in this area are fertilized with a high grade fertilizer at the rate of 1,000 or more pounds to the acre and in many cases the amount exceeds one ton

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to the acre. It is estimated that more than three-fourths million tons of commercial fertilizer are used annually on the one and a half million acres of vegetable crops for fresh market and canning (exclusive of potatoes and sweet potatoes) in the North Atlantic, South Atlantic, and South Central States.

West of the Atlantic coastal region, especially in the Middle West and Pacific Coastal region, only relatively small quantities of commercial fertilizers are required and the cost of production is materially lowered. The question naturally arises, "Can the growers along the Atlantic Coast greatly reduce the amount of commercial fertilizer used per acre, or possibly entirely eliminate its use?" The answer is *no!* Experimental evidence and the experience of growers have shown that commercial fertilizer is a necessity, but it must be used properly to obtain the greatest return for each dollar expended.

Tremendous strides have been made during the past few years with respect to our knowledge of the soil requirements for various crops and their response to fertilization. We know that most of the sandy soils along the Atlantic Coast are naturally low in organic matter and fertility. Continuous cropping over a long period of years without the addition of sufficient organic matter has so depleted the fertility that much of the fertilizer applied is actually lost by leaching or quickly "fixed" into a relatively unavailable state. The continued use of acid-forming fertilizers have aided in leaching the lime and magnesium, and in many cases, rendered the soil too acid for best response to fertilizer. Experiments extending over a period of many years have shown that turning under liberal amounts of organic matter in the form of green manurial crops has increased yields of vegetable crops to such an extent that the increases alone will often pay the entire fertilizer bill.

An abundance of organic matter in the soil helps to reduce loss of plant food by leaching, delays the fixation of phosphorus into an unavailable state, and enables the grower to build up a fairly high nitrogen content. Green manurial crops following highly fertilized vegetable crops utilize the residual fertilizer and turn it back into the soil in the organic form, which is not readily lost. Dr. J. B. Hester, the Soil Technologist at the Virginia Truck Experiment Station, found that heavy crops of soybeans, grown for green manurial purposes on the experimental plats, contained an average of 184 pounds of nitrogen, 34 pounds phosphoric acid, 85 pounds potash, 111 pounds calcium oxide, and 45 pounds magnesium oxide. This

represents more nitrogen and almost as much potash as was applied in the one ton of a 6-6-5 fertilizer used to fertilize the preceding potato crop. Green manurial crops following a vegetable crop utilize not only the residual fertilizer but also considerable amounts of nutrients too slowly available to be absorbed by a rapidly growing vegetable crop. When the green manurial crop decomposes, these nutrients are again available for the next cash crop. Under the Soil Conservation Program this year, vegetable growers are being paid liberally for turning under green manurial crops. There are many acres of depleted soil on which the use of large quantities of commercial fertilizer is really wasteful and cannot be expected to net the grower a profit over a period of years. Such land should be planted continuously to soil improving crops until it becomes fertile.

Soil should be tested for acidity and lime added to bring the reaction to the point best suited to the crop. Crops do not respond properly to fertilization on too acid soils. A lime containing magnesium should be used if the soil tests low in this element or magnesium deficiency has been noted in the previous crops. The use of finely ground dolomitic limestone as a neutralizing agent in mixed fertilizers is recommended as additional insurance against magnesium deficiency.

During the past few years M. M. Parker and R. L. Carolus, of the Horticultural Department of the Virginia Truck Experiment Station, and J. B. Hester, Florence Shelton, and J. M. Blume, of the Soils Department, have devoted the major portion of their time to fertilizer problems. Some of the results already obtained should be of interest to the vegetable grower because they help to answer the question, "How can I get the greatest value out of each dollar spent for fertilizer?"

Recommendations for fertilization are now being made on the basis of the level of soil fertility with respect to the essential plant foods. In the past, recommendations were made on the basis of the crop without consideration of the amount of available nutrients in the soil. In all experimental work at present both the plant and the soil are considered. Rapid chemical tests have been perfected for determining the amount of available nutrients in the soil. Field plat tests are being conducted to determine what fertilizer analysis to recommend for the more important crops grown on soils having low, medium, or high tests for N, P_2O_5, K_2O, MgO, and CaO. The data obtained thus far indicate this information will prove valuable to vegetable

growers. Rapid tests of plant sap for nutrient deficiencies have also been found very efficient in diagnosing the cause of crop failure and making recommendations for fertilizer treatment.

From the previous discussion it is evident that it is difficult to make accurate recommendations for fertilizing vegetable crops without taking into consideration the fertility level of the soil. However, it has been necessary to resort to some systematic type of recommendation for general use. In the following table the important truck crops are placed in four groups with specific recommendations for each group (N means nitrogen; P, phosphorus; K, potash.)

GROUP I—High N—Medium P —Medium K.

Spinach	Broccoli
Kale	Brussels Sprouts
Collards	Loose Leaf
Turnip Greens	Lettuce
Swiss Chard	Endive
Early Cucumbers	Early Beets
	Celery

For these crops apply a 6-6-5 before planting and side dress or top dress with a fertilizer high in nitrogen as a 9-5-4 or with soluble nitrogen salts as nitrate of soda or sulphate of ammonia, or Calnitro.

GROUP II—Well balanced fertilizer carrying amounts of N—P—K in approximately 1-1-1 ratio, such as a 6-6-5.

Potatoes	Eggplant
Head Lettuce	Cabbage
Beets	Peppers
Carrots	Early Snap Beans*

GROUP III—Medium N—High P— Medium K as a 4-8-5, 4-10-5, or 3-10-6.

Snap Beans*	Watermelons
Lima Beans	Squash
Peas	Onions
Tomatoes	Sweet Corn
	Cantaloupes

GROUP IV—Medium to Low N & P—High K.

Sweet Potatoes—3-3-15.

*Side dress with nitrate of soda during early blooming period.

The amounts needed per acre will vary with the crop and the soil. In Group I, applications of from 800 to 1,000 pounds per acre are recommended before planting, with the exception of celery, which requires a heavier application. The amount of topdressing and frequency of application should be determined by the rate of plant growth. Nitrogen alone, instead of the 9-5-4, is recommended as a topdresser for soils testing "good" in phosphorus and potash.

In Group II, applications of 800 to 1,200 pounds per acre are recommended for beets, carrots, and snap beans; and 1,600 to 2,000 pounds for other crops. For eggplants, cabbage, and peppers, the fertilizer should be applied in two or more applications.

In Group III, the recommend-

ed rate is 2,000 pounds per acre for onions and 800 to 1,200 pounds per acre for the other crops. For tomatoes and watermelons, part of the fertilizer should be applied before planting and the remainder as a sidedressing.

Sweet potatoes respond to heavy potash applications. In recent experiments on highly fertilized truck soils with a high test for nitrogen and phosphoric acid, muriate of potash alone at the rate of 600 pounds per acre gave much higher yields than did a complete fertilizer. Sweet potato fertilizer should be applied as a sidedressing after the plants have been set, to avoid fertilizer injury.

To further complicate the situation we have found that the manner in which fertilizer is applied may determine the analysis best suited to the crop. In experiments conducted last year snap beans failed to respond to potash even on soils testing low in that nutrient when the fertilizer was applied in the row and mixed with the soil before the beans were planted. This was due to the fact that potash injured the germinating seed and the seedling plants. The crop gave good response to potash when the fertilizer was applied in bands two inches to each side of the seed. Fertilizer placement experiments conducted during the past few years have shown conclusively that lima beans, snap beans, and peas are particularly sensitive to fertilizer injury. Applying the fertilizer in direct contact with the seed will usually cause so poor germination that the entire crop must be re-planted. Placement one inch directly beneath the seed will retard the rate of germination and materially reduce the stand. Placement directly beneath at a depth of two or three inches is less injurious. Applying the fertilizer in the rows and mixing it with the soil by cultivation may also cause low germination and low yields.

Placement in narrow bands two or three inches to the side and one or two inches below the level of the seed is the safest procedure. It gives the best utilization of the fertilizer materials and the highest yields of beans, peas, and other crops very sensitive to fertilizer injury.

Placement in narrow bands has not proved as satisfactory for tomatoes and cabbage as applying part of the fertilizer in the row and mixing it with the soil before setting the plants and adding the remainder later as a sidedresser.

A New Spray Deadly to Insects

Condensed from Cappers Farmer

Grady Sellards
Kentucky College of Agriculture

A SPRAY solution that has killed every insect it has been tried upon is the most recent discovery at the Kentucky Agricultural Experiment Station. It is a solution of free nicotine in a highly-refined oil. The fact that investigators had worked for years to attain this accomplishment and failed was not disconcerting to Paul Ritcher, an entomologist, and R. K. Calfee, a chemist, of the Kentucky station.

Heretofore, nicotine had to be brought into solution by the use of an intermediate solvent, along with oil. But the solution could not be made permanent; with annoying regularity the components of the mixture kept returning to their original states. And when this happened, the mixture became less effective as a killing agent of insects and of great danger to plants. The nicotine, the base oil, the intermediate solvent, each of them is a substance that burns leaf surface if applied too liberally or in concentrated form. It is the impurities of the oil, or too much of the spray on leaf surface, that burn. So if they could obtain an oil practically free of impurities, reasoned Ritcher and Calfee, make the nicotine unite with it in a permanent solution, and then devise a means of spreading the solution lightly over leaf surface, the result should be a deadly insecticide that wouldn't burn plants.

These men obtained the highly refined oil, put with it some free nicotine, gave the mixture a thoro shaking and there it was—a permanent solution of nicotine-in-oil. But this had in it some impurities in suspension, which settled out after they had been centrifuged.

To test the insect-killing properties of the solution it was tried in different strengths, and in comparison with widely used spray materials. They were amazed at the effectiveness of the new discovery. A two-and-a-half per cent solution of free nicotine-in-oil killed 80 per cent, and a five per cent solution killed all insects it was tried on. Mixtures of two and one-half per cent, and 5 per cent, respectively, of free nicotine in aqueous Aresket killed no in-

Reprinted by permission from Cappers Farmer

sects. "But," think Ritcher and Calfree, "a three per cent solution of nicotine-in-oil will kill any insect." They found that a 1½ per cent solution of free nicotine-in-oil killed a surprisingly large per cent of all the 25 species of insects sprayed, including such hardy ones as white fly, stink bug and squash bug.

"In the comparisons," say Ritcher and Calfee, "the nicotine-in-oil exhibited a spectacular knock-down that was much quicker than any other toxicant used." When it is known that one drop of free nicotine is enough to kill a man, the deadliness of the product upon insects can be more fully appreciated. "But to be effective on insects," says Ritcher, "free nicotine must have the proper carrier and be properly applied — yes, and be alkaline."

Alkalinity is what frees nicotine so it can get in its work. Occasionally, activators, such as sal soda, are used for this purpose.

"How does nicotine kill insects?" I asked. "It goes thru the body surface or breathing pores, or both," answered Ritcher, "and paralyzes the insect. In some instances a weak solution may do no more than paralyze." At that point he took up his improvised spray apparatus and started toward the end of the greenhouse where there were some clover plants heavily infested with aphids. And the instant he started work on the aphids with a light fog of the new liquid, they began to let loose and fall off, paralyzed.

"But when these insects recover from their paralysis?—"

"Well," he answered, "they'll starve and die because they can't get back up the plant." After this little demonstration, I was given to understand that the temperature was a little under optimum for the new spray solution to be fully effective. "About 70 degrees or higher," is the right temperature for best results.

Broadly speaking, there are two kinds of insects which feed upon food crops—one that bites off and chews, another that pierces the leaves of plants and then takes its food thru a proboscis, a tube-like mouth part. Both are controlled principally by poisons, administered as components of sprays or dusts. Hitherto, no single spray has been satisfactory in controlling both kinds of insect. No single spray has been effective even in controlling all species of injurious insect or either large group.

The chewing type is killed by poisonous sprays applied to plants on which the insect is feeding. The piercing-sucking type, on the other hand, extends its proboscis down thru the poison and eats merrily on, without harm from the poison. To curb

the activities of this one, a contact spray must be used. This spray passes thru the breathing apparatus of the insect or thru surface of body, and then poisons, or, more rarely, clogs the breathing pores, causing suffocation.

Apparently the new nicotine-in-oil-solution, in contrast, takes practically all comers of the insect world, whether they take their food man-fashion or baby-fashion, and is both deadly and fast in its action. The new product is effective if only a slight amount hits the insect, whereas, to be effective many of the commonly-used contact sprays must cover the insect thoroughly. After the nicotine-in-oil, lightly applied, get in its work, it quickly evaporates, leaving the plant leaf free of the objectionable residue, characteristic of arsenical sprays. So objectionable are certain of these poisonous residues that Government agencies are taking a firm stand, with regulations prescribing that certain food crops may not be marketed unless practically free of residue.

How was the spray to be applied? And that is of paramount importance. How could these workers spread so fine a mist over a leaf that the material would not collect in drops and burn? Of course there was but one way to break a solution into a mist, and that was by the use of an atomizer. But, unfortunately, the atomizer is a device that produces a mist only on the outward stroke of the plunger; then, too, at the point where the liquid is transformed to mist, drops always form. Both of these were serious objections, making the atomizer principle unsatisfactory for commercial development, unless the device could be so improved that the mist would be continuous and no drops would form. Here again, these explorers of the unknown, after repeated efforts, came forth with a device that produces a continuous mist, with no drops forming. All that was needed was an enclosed air chamber, just back of the liquid compartment of the atomizer.

An impressive feature of the new spray material is the small amount needed per plant. "A half pint," declares Dr. Walter Price, who as Head of the Department of Entomology and Botany in the Kentucky Station and who, with Dr. J. S. McHargue, Head of the Department of Chemistry, planned the project, "is sufficient for a row of beans 100 feet long. And the cost of this amount is about 4 to 5 cents." He pointed out also that 2 to 4 gallons, costing 35 cents a gallon, should be ample for an acre.

Why and How Calves Get Rickets

Condensed from The Dakota Farmer

G. C. Wallis
South Dakota State College

RICKETS is likely to develop in the late winter months and often afflicts some of the best-fed, most rapidly growing calves. This applies especially to baby beef animals and calves receiving heavy grain rations with only small amounts of hay. Calves receiving poor rations also fall victims to the ailment.

One of the first symptoms to be noted is the fact that the calf seems a little stiff, its head may hang a little low, and it hesitates to move around very freely. The knees may begin to swell a little and soon to buckle forward, perhaps spreading outward a little as viewed from the front. Swelling may also be noted in the hock and ankle joints, causing the animal to stand with its weight tilted forward onto the toes. Often the back becomes humped up and stiffness is so severe that the animal merely hobbles along, with the least possible flexing and bending of the spine and limbs, when it is forced to move around. It soon begins to lose its appetite, stops growing, develops a rough, coarse coat of hair and, if it doesn't die, it at least becomes unprofitable. In severe cases, the legs become so badly crippled that the calf cannot get up. Many times the trouble has been wrongly attributed to the lack of exercise, or it has been decided that the calves were "foundered." True, the calves will usually begin to improve when the weather becomes nicer and they can be turned outside more, but the exercise has little to do with the cure. In addition to these readily observable symptoms, laboratory studies have revealed other conditions characteristic of this disease:

(1) The bones of such animals are soft, thin-walled, porous, fragile, light in weight, and easily broken. If a six-inch span of the thigh bone of a rachitic calf is supported only at the ends and pressure is applied at the center, it will take only about 700 pounds to break the bone according to tests made at South Dakota State College. It will take a pressure of about 3,000 to 4,000 pounds to break a similar bone from a normal calf of the same age.

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(2) The concentration of the bone-forming minerals in the blood stream of a rachitic calf may be only about one-half of the amount expected in a normal calf. Since the blood stream must carry these bone-forming minerals from the digestive tract to the place where they are used in the bones, the seriousness of the condition is obvious.

(3) Rachitic calves may be retaining for bone-building purposes little or none of the minerals in the feeds supplied. Indeed, in severe cases they may be losing some of the minerals which they already had stored. When one considers that the bones of young calves should be growing and mineralizing rapidly, it is quite evident that mineral losses from the body could not be sustained for any length of time without serious consequences.

Medical men described rickets, as it affects human beings, some two centuries ago, but it is only within recent times that we have gained some knowledge of the details concerning its cause and cure. About fifteen or twenty years ago, we began to recognize the fact that young chicks, pigs, sheep and puppies were subject to a similar trouble. In the last four or five years, it has been definitely shown that calves may also fall victim to a rachitic-like disease.

Rickets is primarily a disease of developing bones. Normal bones increase in length by the continuous growth of a layer of tough, elastic cartilage just back of the tip end of the bone. The back side of the cartilage layer continuously receives a deposit of calcium and phosphorus, the bone-forming minerals, to give it the strength and hardness characteristic of healthy bones. When rickets develops, the cartilage continues to grow but the necessary minerals to give strength and hardness are not properly deposited in the bone. As a result, large knobs or beads of cartilage develop at the joints and the soft bones are forced into abnormal shapes by the weight and strains of the body which they are now unable to withstand. This accounts for the cramped chests, bowed legs, humped backs, curved spines, swollen joints, stiffness and soreness which accompany a severe case of rickets.

There are two important possibilities to be considered in trying to determine why the bones have not become mineralized. In the first place, there may not have been enough minerals in the feed given the calf to supply the necessary calcium and phosphorus for building of strong bones had it all been used efficiently for that purpose. Secondly, there may not have been enough vitamin D present to allow for efficient and

proper use of the minerals even though they were available in sufficient quantities.

The name "vitamin" has been given to those recently-discovered food substances without which the body cannot function normally, but which are present in exceedingly small amounts, making it difficult to separate them out for identification. We now recognize several members of the vitamin family, known primarily because of the troubles that develop when they are lacking and the cures obtained when they are supplied. Vitamin D is the one that is necessary for the proper utilization of the bone-forming minerals. Without it, the calf is unable to take the calcium and phosphorus in the feed, transport it by means of the blood stream to the placed needed, and deposit it in the newly-formed cartilage to make normal healthy bones.

Rickets is not a germ disease and, therefore, not spread from one calf to another. It results from a lack of sufficient calcium and phosphorus in the ration, or a deficiency of the vitamin D necessary for their proper utilization or, more probably, a relative deficiency of both minerals and vitamin D.

With these thoughts in mind, let us see why a seemingly well-fed calf develops a case of rickets in February or March. In the first place, the calf should be growing rapidly, making necessary liberal amounts of minerals and vitamin D for healthy bone formation. The heavy grain ration which the calf is probably consuming contains but a very restricted amount of calcium. Furthermore, the grains carry little or no vitamin D. Roughages furnish liberal amounts of calcium, alfalfa being especially good in this respect. Roughages also furnish the only feed source of vitamin D during the winter months. With a liberal grain allowance, the calves will usually eat only a small amount of roughage, so the conditions naturally favor a shortage of calcium and vitamin D.

Presumably, the calf might make use of the well-known antirachitic, or vitamin D, action of sunshine, but at this season of the year they are usually indoors most of the time, and besides the antirachitic action of the sunshine is not very appreciable in northern districts during the winter months. Any storage of vitamin D which the calf may have had in its body from the previous summer season would become more depleted as the season progresses.

By putting all of these points together, we have a reasonable explanation for the occurrence of rickets in a well-fed calf during the late winter months. It is also

true that calves on a poorer ration and in a less thrifty condition may also encounter a mineral and vitamin D deficiency, and in that event they, too, will fall victim to the disease. When spring comes and the calves which have not died are turned out into the increasingly-effective antirachitic action of spring and summer sunshine, and are changed to a better ration, their rachitic condition begins to disappear.

Many of the steps for prevention and cure have already been indicated. Rickets is not likely to occur when calves are fed ordinary farm-grown feeds to the best advantage. For instance, if a short yearling calf was fed three or four pounds of good alfalfa hay per day, a liberal amount of calcium would be supplied. It has also been found that this amount would carry sufficient vitamin D to be quite effective in utilizing the minerals. The amount of vitamin D in hay varies, depending in part upon the amount of sunshine exposure during the curing process. One can never be sure just how much the hay supplies but there is usually some present. In a few tests made at the South Dakota Experiment Station, alfalfa has been found to be more potent in vitamin D than prairie hay. Corn silage also supplies some vitamin D.

Corn, oats and barley furnish reasonable amounts of phosphorus; while bran, oilmeal and cottonseed meal are especially rich in this mineral. If enough grain is fed with the alfalfa hay to make a complete ration, there will be sufficient calcium and phosphorus to meet ordinary demands. If, in addition, the calves are allowed to be outside to take advantage of what little antirachitic action there may be in the winter sunshine, there is not likely to be much trouble from rickets.

There seems to be an intimate relation between the amount of vitamin D and the amount of minerals necessary to keep a calf in good condition. If the amount of minerals supplied is very liberal, then less vitamin D will suffice; again, if mineral allowance is scanty, then more vitamin D will be required.

When calves have to be wintered on poor roughage and a scanty concentrate allowance, a little bone-meal added to such a ration would provide large amounts of calcium and phosphorus at a minimum of expense. It could be fed mixed with the salt at the rate of two parts steamed bone-meal to one part of salt; or it might be mixed in the grain so a calf would get about a tablespoonful per day.

Should rickets develop, the mineral allowance should be increased by a change in ration or

by the addition of bone-meal, and about two tablespoonfuls of bulk cod liver oil should be given to each rachitic calf daily to supply additional vitamin D. Ordinarily, it is best to utilize to the fullest extent the sources of minerals and vitamin D available in the natural farm feeds before resorting to the use of purchased supplements. Experiments have failed to indicate any measurable improvement in a good farm ration by the addition of bone-meal and cod liver oil supplements. However, with only poor roughages and a scanty grain allowance available, there is a possibility of sufficient improvement in the growth and thriftiness of the calf to more than compensate for the cost of these supplements.

Artificial Manure

A new method of making artificial manure, a variation of the English method developed at Rothamsted Experiment Station, was used on eastern farms for the first time last year. The method calls for plowing under a heavy growth of rye or Sudan grass, or even a crop of weeds. As the heavy growth is plowed under, a chemical reagent, composed of soluble nitrogen and lime, is turned under with it at the rate of 500 lbs. per acre to hasten decomposition. The reagent costs about $8 per acre.

Spreading the reagent is a simple matter. A wooden hopper with small holes in the bottom is fasten on the rear of the tractor. The granular reagent falls by gravity and covers a strip as wide as the plow turns over.

Some of the farmers who used this method plowed under winter rye in spring, then planted a crop on the ground. Others took an early crop from the ground, then sowed Sudan grass for plowing under with the reagent, and later took off a late crop. Results were more satisfactory than with barnyard manure.—*From the Farm Journal.*

New Grapes Replacing the Old

Condensed from New Jersey Agriculture

J. Harold Clark

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THE grape varieties grown commercially in New Jersey during recent years have been mostly such old sorts as Concord, Niagara, and Ives, while many others have been produced in a limited way. The department of pomology of the Experiment Station has tried out many of these older varieties and at the same time has endeavored to obtain and test all the new ones that seemed to have any possible value. Recently some new varieties have been introduced that may eventually take their place as so-called standard varieties. The purpose of this article is to call attention to some of these promising new grapes as well as to list certain old varieties that should be avoided in future plantings.

The varieties here recommended for planting are based on their performance at New Brunswick and, in some cases, at other points in the state of New Jersey.

The list recommended for commercial planting has been divided into two classes. Class 1 includes only varietines suited to commercial production and to a rather wide range of soil types. Only three varieties are placed in this class: Concord, Fredonia, and Niagara. In Class 2 are included varieties that are satisfactory for commercial production under certain conditions or that are adapted to production for a limited purpose as for juice only or for local sales only. Class 2 includes Adams (for juice only), Brighton, Brocton, Golden Muscat, Noah (for juice only) and Sheridan.

Some of the varieties in Classes 1 and 2 are comparatively new but they have been tested sufficiently to warrant their recommendation. Other introductions, some of them quite recent, have not been grown long enough so that a definite appraisal of their worth can be made. They are included in the following classes, based on limited observations. Class 3, Commercial — New and Promising—Erie. Class 4, Commercial — New and of doubtful value—Dunkirk, Hanover, Ontario, Portland, Ripley, Seneca, Urbana, Watkins, Wayne.

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Many varieties that have been tested on the Horticultural Farm are not recommended because there are better varieties now available for the same reason and purpose. Most of these are old varieties, but a few new ones are listed as being of little value.

Class 5. Should be discarded— (a) Old — Agawam, America, Armalaga, Berckman, Brilliant, Caco, Campbell Early, Carman, Catawba, Champion, Clevener, Clinton, Diamond, Duchess, Early Daisy, Eclipse, Ellen Scott, Empire State, Eumelan, Highland, Iona, Ives, Lindley, Lucile, Mericadel, Merrimac, Moore Early, R. W. Munson, Salem, Vergennes, Wapanuka, Wilder, Winchell, Worden. (b) New — Beta, Keuka, Melton, Pontiac.

Varieties for the Home Garden

Probably no fruit is so universally grown in the home garden as the grape. Concord and Niagara are the two varieties most commonly found on arbors around the home as they will grow well under different soil conditions and will withstand neglect better than most other sorts. It is desirable, however, to have early, medium, and late ripening varieties of different colors and flavors to choose from in a home garden list. The following list, arranged in order of ripening, includes new and old varieties suitable for home use: Erie, Portland, Fredonia, Ontario, Delaware, Niagara, Brighton, Brocton, Golden Muscat, Concord, and Sheridan.

Included in the recommended lists are a number of varieties which have originated as the result of a plant breeding project at the Agricultural Experiment Station at Geneva, N. Y. The following descriptions of these promising new grapes are based on their performance on the Horticultural Farm at New Brunswick.

Fredonia

The Fredonia is the only new variety to be placed in Class 1, Commercial list. It merits this distinction because of its ability to maintain good growth and production under a wide range of conditions. It is vigorous, productive, fairly resistant to disease, and of fair to good quality for its season which is about that of Moore Early. It is so much more productive than Moore Early that it will probably replace that variety entirely.

Consumers do not want grapes too early in the season but there is usually some demand for early black or blue grapes and Fredonia is the best of that type.

Erie

Erie has fruited at New Brunswick only two years but it appears to be a promising, very early black grape, ripening even

earlier than Fredonia. In quality it has appeared to be a little superior to Fredonia.

Brocton

Brocton is inclined to bear too heavily and so must receive good soil treatment and rather severe pruning. For extra fancy table grapes it would probably pay to thin the fruit by removing the smaller and poorer bunches on the vines which are over-loaded. This has been done with very satisfactory results in the vineyard at the Horticultural Farm for the last three years.

Golden Muscat

Of all grapes that are hardy in this part of the country, Golden Muscat at its best is surpassed by none for size and attractiveness of cluster and for quality. It is an oval shaped, white variety, turning a deep golden when fully ripe. It is a vigorous grower but seems to require just the right combination of soil and climate to achieve its highest quality. Probably the best quality at New Brunswick was reached in a very dry year on a rather dry, gravelly hillside where other varieties were injured to some extent. The thing which prevents Golden Muscat from becoming a standard commercial variety is its tender skin, which combined with the great size and weight of the clusters makes shipping in good condition impossible. As a roadside market variety, or for home use, this grape should find a permanent place.

Sheridan

This variety has so many good qualities that when it was first introduced there were some who thought it would replace Concord. Its late ripening date, a week to ten days later than Concord, however, eliminated that possibility in the northern grape districts where it is too often caught by frost. Sheridan has fruited for several years at New Brunswick and so far has matured early enough to escape early freezes. It is doubtful, however, whether Sheridan will become an important commercial variety, because it must be given special culture. It is inclined to be over-productive and must be heavily fertilized and heavily pruned. It is a very desirable variety for those who can give a small vineyard special care. Sheridan is blue black with very compact clusters and berries somewhat larger than Concord. The skin is tough and the clusters do not wilt down after picking as Concord does, making it a much better shipper and keeper than that variety. The writer has had Sheridan clusters in a fruit bowl in the house for a month and the fruit was still good.

Portland and Ontario

These two varieties are frequently mentioned together as they are both very early, produc-

tive, white varieties of high quality. Both are too soft for shipment but can be recommended for the home garden. Portland is a day or two earlier than Ontario but has a decided musky aroma which appeals to some more than the delicate flavor and aroma of Ontario. It is said that Ontario is being planted in New York for wine purposes to a limited extent.

A number of other new seedling varieties are under test at the Horticultural Farm and plant breeders in various states are working continually to produce additional new ones. Considerable progress has been made, for instance, in producing seedless grapes that will be hardy in the east. During the next few years the lists of recommended varieties of grapes, as well as most other fruits, are likely to change considerably as further improvements are made. The progressive grower will want to keep in touch with these changes and try out the most promising new grapes as they appear.

Exercise Doesn't Toughen Meat

Experiments by the Department of Agriculture and university experiment stations are revealing some factors influential in meat quality and tenderness.

A traditional belief—almost a superstition—among many farmers is that exercise means tough meat. At the University of Illinois recently an experimenter set out to test the scientific soundness of this belief. He divided a herd of beef, forcing half to exercise for half of each day in a tread mill which certainly kept them jogging along, while the others were confined in their stalls. Feed rations for both lots remained the same. This went on for three months and the beef animals went to market. It was found that meat from the leaner, exercised cattle was more tender and of generally better quality.

A similar experiment probably is behind a recent recommendation of the Department of Agriculture that to get bigger and finer drumsticks, more and tenderer white breast meat on poultry, allow them to range freely for 20 to 25 weeks before placing them on the fattening diet. The department says that this exercising does not detract from tenderness but does contribute to finer and meatier birds.

—The Washington Farmer.

Weeds Worse Than Mortgages

Condensed from The Farmer

William H. Kircher

THE statement that a heavy infestation of field bindweed is a $40 per acre mortgage on any man's farm," comes from Dr. H. K. Wilson, agronomist of Minnesota Agricultural College, and it is a conservative estimate, for once field bindweed (creeping jennie) sets its roots in a piece of land it will continue to spread until it has cost about that much to get rid of it or bring it under control.

So serious has become the infestation of field bindweed and leafy spurge on some of the best farmlands in Minnesota and the Dakotas that state and federal authorities have joined forces to fight the menace, and here and there over the Northwest farmers are trying various eradication and control methods.

Thus far efforts at eradication and control have centered around the following three general methods:

1. Fallowing with various kinds of tillage tools, and at varied intervals.

2. Smothering, either with smother crops or, on small patches, with such impervious materials as building paper.

3. Use of various chemicals, the most commonly used chemical being sodium chlorate.

All of these methods were in use last year on the weed experimental farm near Lamberton, Minn., and will be tried again during the coming growing season. This farm was rented in the Spring of 1936 under a long lease to be used solely for the purpose of experimenting on weeds. Cooperating in the experimental work are Minnesota Agricultural College, the State Department of Agriculture, and the United States Department of Agriculture.

When this 160-acre farm was taken over for experimental work, there was on it a most excellent demonstration of what eventually comes of field bindweed infestation. There was hardly a single square rod on this entire farm, including the front yard, which was not solidly infested with field bindweed. As in all cases of solid infestation, the farm had become more and more unproductive with each passing year. Best evidence of its unproductiveness was the fact that during the 18 years before it be-

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came an experimental farm, there were nine different tenants on it, each of them finding it necessary to move because they couldn't make it pay.

An extensive program of fallowing, use of smother crops, and chemicals was undertaken on the farm last year. The smother crops, corn and cane seeded with a grain drill, millet, buckwheat, succotash, Sudan grass, hemp, and others were of little value in smothering weeds last year because the drouth allowed for so little growth that there was insufficient foliage to do the job. In fact, the bindweed, being deep rooted, got enough moisture to keep on growing while the plants, which it was hoped would do the smothering, were dwarfed by the drouth and the weeds. It was a case of the bindweed turning the tables on the smother crop.

Last fall one plot on the farm was seeded to winter rye as a smother crop, and another was seeded to winter wheat. Just as soon as these two crops are harvested next summer, the plots will be cultivated and seeded to some such crop as sorghum which can get a start in dry weather and produce a cover for the remainder of the growing season. Scores of other plots are being staked off on the land so that various other smother crops, methods of fallowing, and of treatment with chemicals may be tried.

It is the hope of those in charge of the farm that there will be evolved through the experiments with tillage and smother cropping, methods which will allow for ultimately fully controlling the bindweed infestation, yet which will allow for a profit from farming operations while the bindweed is being brought under control.

At South Dakota State College experiment station, where field bindweed control work has been carried on several years under the direction of Dr. A. N. Hume, head of the college's agronomy department, and C. J. Franzke, Dr. Hume's assistant, there has been developed a smother crop-fallow combination which seems to offer much promise as a means of controlling bindweed. This system consists of winter rye, followed immediately with fallowing until the end of the growing season.

On a plot of the experimental farm near Brookings there was a count of 63 field bindweeds per square yard at the end of the 1933 growing season. This plot was plowed five inches deep May 29, 1934. June 4 it was double disced and double harrowed and planted to cultivated rows of Sudan grass and cultivated four times. This grass was harvested on September 14, the soil worked and the plot seeded to winter rye September 15. On

July 12, 1935, the rye was harvested, yielding 24.8 bushels per acre, and fallowing started immediately. First the ground was plowed five inches deep. That was on July 19. It was disced on August 2, and duck-footed August 6, 12, 19 and 26, and September 3 and 20. Winter rye was seeded again on September 21, and harvested July 19, 1936.

A count of weeds was made just after harvesting the rye crop and it was found that the number of bindweeds had been reduced from the original 63 per square yard to an average of 7.6 per square yard. That is nearing eradication, but not getting quite close enough to allow for carelessness in the cropping system which follows, because these few bindweeds that remain would reproduce themselves and there would soon be another solid infestation.

On another plot an even more successful winter rye-fallow system was followed. Instead of seeding Sudan grass and harvesting it just before the seeding of winter rye, this land during the first season was black-fallowed all summer, and seeded to winter rye September 15, 1934. This rye was harvested July 12, 1935, making an average yield of 43.4 bushels per acre as compared to the 24.8 bushels per acre of the rye following Sudan grass.

As soon as this rye crop was taken off, the fallowing was begun and continued until September 20, 1935, when rye again was seeded. When this second crop of rye was taken off a count was made of the surviving field bindweeds. There was an average of less than one per square yard whereas there had been an average of 67 per square yard at the outset, a kill of almost 100 per cent. This rye-fallow system is being continued on this plot now and it is believed that by the end of the growing season there will not be a bindweed on it.

The rye-fallow method of control and ultimate eradication has proved more practical on large areas than other methods. Not only does it allow for taking a crop off the land, but it does kill the bindweeds, and it does the killing at comparatively low cost. However, this method not being practical where the weeds to be eradicated are confined to small isolated areas, such areas must be dealt with differently. Under such conditions the use of chemicals is practical. Dr. Hume and Mr. Franzke started their experimental work with chemicals 11 years ago. The most practical, they have found, are the chlorate mixtures.

Smothering through the use of impervious cover on small areas also has proved a means of eradication. At the Cottonwood experiment station in 1933, there

was on one of the plots a patch of bindweed about four rods across at its widest point. This was covered with a mulch paper for about a year, from 1933 into the growing season of 1934. No plants came up in 1934 after the mulch paper was taken off, but a few plants did appear later and these were eventually killed out by cutting them off with a sharp hoe on alternate days in the spring.

One thing of importance in laying mulch paper is the covering of an area larger than that covered by the bindweed. This prevents the weeds coming up from roots that extend beyond the area in which the weeds appear. The strips of paper also must be overlapped to prevent the weeds coming up between them. In their directions for laying the paper, Dr. Hume and Mr. Franzke also point out that: "The bindweed should be allowed to grow before covering with tar or mulch paper —allowing about five or more inches of vine growth. The area to be covered should then be hoed off smooth. It may be necessary to level with an ordinary garden rake. If the ground is leveled off smooth before laying the paper," they point out, "it eliminates air pockets, and the paper is not likely to be blown or torn by the wind."

Dr. Hume and Mr. Franzke emphasize the importance of impervious cover in the smothering of small field bindweed patches. They tried covering an area with a heavy layer of straw, but because the layer of straw was not impervious to air and light the weeds continued their growth.

In all successful eradication and control methods, persistence counts as much as the method itself. If it is the rye-fallow method or straight fallowing there must be power enough and enough tillage machinery to allow for keeping constantly at the fallowing job through the growing season. When there is no smother crop growing, the ground must be kept black so that not a single bindweed appears above the surface. If chemicals are used, their use must be continued until the last weed is dead. If small patches are covered with mulch paper, they must be kept constantly covered so that the weeds get no sun or air for at least a year.

Although in this article most of the experience recounted has been with field bindweed, commonly known in much of the Northwest as creeping jennie, the same methods are applicable to leafy spurge.

To Buy or Raise Herd Replacements?

Condensed from American Agriculturist

E. S. Harrison

Department of Animal Husbandry, Cornell University

EVERYONE connected with breed improvement work or engaged in disease control and elimination would like to consider the argument "to raise or purchase dairy herd replacements" a closed question. On the other hand, the practice of raising dairy replacements is frequently questioned from an economical standpoint.

In recent years most of our dairy heifers at Cornell have been raised on experimental rations so we have accurate records on food consumption. On the basis of these feed records, the total feed cost of raising a fall-born heifer from birth until the freshening age in our herd is as follows:

From birth to six months					
Whole milk	350 lbs.	@	$ 1.70 cwt.—	$ 5.60	
Calf starter	265 lbs.	@	3.25 cwt.—	8.61	
Fitting ration	370 lbs.	@	1.50 cwt.—	5.55	
Hay	700 lbs.	@	12.00 ton —	4.20	
					$23.96
From six months through eight months					
Fitting ration	240 lbs.	@	1.50 cwt.—	3.60	
Hay	600 lbs.	@	12.00 ton —	3.60	
					7.20
From eight months through 13 months					
Pasture	5 months	@	2.00	— 10.00	
					10.00
From 13 months through 20 months					
Fitting ration	630 lbs.	@	1.50 cwt.—	9.45	
Hay	3150 lbs.	@	12.00 ton —	18.90	
					28.35
From 20 months through 25 months					
Pasture	5 months	@	2.50	— 12.50	
					12.50
From 25 months through 27 months					
Fitting ration	360 lbs.	@	1.50 cwt.—	5.40	
Hay	900 lbs.	@	12.00 ton —	5.40	
					10.80
Total feed cost					$92.81

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Obviously the cost of feed does not represent the total cost of raising a dairy heifer. The largest cost, other than feed is labor, which under our conditions would not exceed $20.00 per heifer. At the same time, it must be kept in mind that on the average dairy farm, no extra labor is required to care for the heifers. It is necessary to have a certain amount of help to do the milking and this help will have plenty of time to feed and care for the heifers between milkings. The value of the manure on the farm is certainly sufficient to more than cover the cost of bedding. The housing cost is difficult to estimate because it will vary with each individual condition. On the average dairy farm, however, it is doubtful whether the investment in the buildings used to house heifers will exceed $125 per stall. On the basis of 5 per cent interest on the investment, this would mean a charge of $6.25 per year or $12.50 per heifer for the two years.

The initial value of the calf in the commercial herd will range from $5.00 to $25.00, depending upon the merit of the dam and sire. The average value would be approximately $15.00. Thus the total cost of producing a heifer for the milking herd would be close to $140 when all costs are considered.

In considering this cost, let's not lose sight of the fact that the heifer has provided a market for roughage and pasture that might otherwise be difficult to market, and employment for labor that might otherwise be idle. To the average dairyman it is important that this investment has been made over a period of two years, with a relatively small cash outlay, contrasted to the purchase of a replacement, which requires that the total investment be made in cash.

Let us assume for the moment that the answer to the question, whether a dairyman should raise or purchase his replacements, depends entirely upon comparative costs. For a recent two months' period, a total of 501 Holstein cows has been sold over the auction block at an average price of $151.75. In arriving at this figure, only those sales featuring good commercial purebred dairy replacements have been used. For example, a dispersal sale of 150 Holsteins for an average of over $500 per head was not included because these animals were purchased as breeding foundations rather than commercial dairy replacements.

The foregoing figures indicate quite clearly that a high class cow can be raised as cheaply as she can be purchased. I do not question the fact that poor cows (those with low producing ability) can be purchased for less than $140 per head, but they usually prove

expensive at any price. Remember that it costs just as much to grow and develop a heifer with a low inheritance for production as it does a heifer that has high inheritance for production. No heifer should be raised that is not worth for dairy purposes what it costs to produce her. The cheapest time to cull is at the time the heifer is born.

But the question of raising replacements or purchasing them cannot be determined entirely upon the basis of cost. For example, let us assume that dairy replacements could be purchased for less than the cost of production and therefore a large number of dairymen stopped raising replacements. When cows were needed, these dairymen would naturally purchase the best replacements they could find at a given price. If no heifers were raised from these better cows, as far as the future of the industry is concerned, they might as well have been sent to the slaughter house. Obviously future replacements must be raised from the inferior cows left behind. How long could the dairy industry operate under such a policy?

It has long been recognized that any purchased replacement for a dairy herd must be considered as a possible carrier of disease. Regardless of how carefully these purchases are made, sooner or later a serious disease, will be introduced into the herd which could easily wreck it. The disease problem is practically forcing many dairymen to change their policy and to start growing their own replacements.

Corn Roots

Corn roots are abundant and extend far into the ground. One hill of three stalks will produce roots which, if placed end to end, would measure about one mile in length. To illustrate the amount of roots in one field of corn: eight rows eighty rods long have enough roots to make a continuous root string that would reach from Los Angeles to New York City. In a field eighty rods long and forty rods wide, enough roots are available to make a string more than seventy thousand miles long, the distance of nearly three times around the globe.—*From Cappers Farmer*.

Mineral Supplements and Hay Requirements

Condensed from The Rural New-Yorker

R. W. Duck

RECENT work conducted by Prof. Oscar Erf, Ohio State University, presents some valuable, interesting and conclusive evidence relative to mineral influence on kind and quality of hay needed in livestock production with special reference to high producing dairy cows.

Prof. Erf advises in part as follows: "For the past twenty-eight years we have been working on mineral problems, and we have formulated a so-called mineral ration for deficiencies in animals which have been arrived at by determining the deficiencies which occur in high-test cows. The ordinary cow gives us no basis upon which to work because of the great variability she has. Consequently we have formulated a ration which has been fed for the past seven or eight years with increasing production in each generation."

Monocalcium phosphate	15 lbs.
Calcium phosphate (bonemeal, 24% protein)	20 lbs.
Dicalcium phosphate	25 lbs.
Sodium bicarbonate	13 lbs.
Charcoal	12 lbs.
Odorless bloodmeal	8 lbs.
Calcium chloride	4 lbs.
Magnesium chloride	4 lbs.
Magnesium sulphate	2 lbs.
Sulphur	4 lbs.
Potassium carbonate	1 lb.
Potassium aluminum sulphate	12 ozs.
Potassium iodide	8 ozs.
Iron ammonium citrate	8 ozs.
Manganese phosphate	4 ozs.
Sodium silicate	4 ozs.
Copper sulphate	2 ozs.
Bismuth subnitrate	½ oz.
Strontium lactate	½ oz.
Sodium bromide	¼ oz.
Zinc oxide	¼ oz.
Stannic chloride	¼ oz.
Stannum	¼ oz.
Calcium fluoride	⅛ oz.
Cobalt chloride	⅛ oz.
Jaborandi	14 ozs.
Black haw	15 ozs.
Paprika	18 ozs.
Juniper berries	2 ozs.
Fenugreek	2 ozs.
Anise seed	2 ozs.
Caraway seed	2 ozs.
Quassia	⅛ oz.

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Feed 24 pounds to one ton of feed.

Prof. Erf brings out the following important considerations on the influence of minerals relative to Timothy and Alfalfa hay. Frequently cows receiving good quality Alfalfa hay prefer Timothy to such hay, and they respond better in production to mixed hay rather than Alfalfa exclusively. In some sections considerable digestive trouble is experienced with heifers and calves which are fed a high quality Alfalfa hay. Prof. Erf's investigation shows that by feeding four ounces of sodium silicate with the mineral ration to a herd of cows fed Alfalfa exclusively and green grass during the Summer, there were very favorable results both as to production and physical response particularly in bone and tendon formation. Timothy hay is relatively high in sodium silicate and the desire for this hay is probably caused by a deficiency of this mineral. Cows which do not receive it had digestion disorders of a more or less minor character.

Prof. Erf states: "Since 1912 we have fed sodium silicate in the mineral ration of a large number of test cows, especially where no good Timothy is available and where only Alfalfa and corn silage are fed entirely as the forage of the ration. Due to the large amount of calcium in much of the Alfalfa that is raised it becomes a question of whether silica, which as a rule is more abundantly furnished in Timothy and largely in oat hulls, does not also become a balancing factor for the calcium and magnesium in the Alfalfa. So far we have found these methods of feeding practical."

Prof. Erf has also done considerable work relative to the feeding of iodine at different levels to dairy cows. It was found in their investigations that adding increased amounts of iodine to the diet of dairy cows has produced beneficial results when fed in optimum amounts or, in this instance, even in amounts in excess of the normal requirements. From twenty years of experience in adding iodine to dairy cow rations there has in no instance been objective evidence of unfavorable effect directly or indirectly attributable to the iodine intake. In fact in most instances where an added iodine food has been instituted, the milk production and the fertility of the cows have increased.

Where a more simple mineral mixture is desired which supplies most minerals needed or required for normal or average production, growth and gains, the following would probably meet such requirements:

Iodized stock salt .....100 lbs.
Ground limestone .....100 lbs.
Steamed bonemeal .....100 lbs.
Sodium silicate ..... 10 ozs.

After thorough mixing this may be added and mixed in well with each ton of home-grown and home-mixed grain or home-mixed concentrates. This would be of special value and benefit when Timothy hay or poor quality roughage was used. Almost all commercial concentrates have minerals mixed with them to an extent which the various manufacturers have found desirable. It is therefore not usually a good plan to add more minerals, thus increasing their forced feeding. In such cases and even when mixed with the home mixture it is very desirable that the suggested mineral mixture be kept available before all livestock, including horses, cattle, sheep and hogs, in a clean dry place and container where they can help themselves to it as needed or desired. Young growing animals especially should have free access to this mineral mixture to meet needed mineral growth requirements.

Give Lespedeza Half a Chance

Condensed from Progressive Farmer

A. J. Pieters

of the United States Department of Agriculture

LESPEDEZA has been in the South for a long time, nearly a hundred years in fact, but still we haven't got enough of it. Lespedeza is a lifesaver for a land in need.

What with so much soil eroded or worn out by long cotton culture and with low yields of cotton, the South needs a crop that will do these three things:

1. Help stop soil erosion.
2. Add pep to the soil, enabling it to produce bigger crops of cotton and corn, and—
3. Furnish hay and grazing.

Will lespedeza do all this? If given half a chance, it will. At the Statesville, N. C., soil erosion station a hillside plot of ground with an 8 per cent grade planted to lespedeza showed a run-off of only 10.7 per cent with a loss of soil of 0.8 tons per acre, while one in bare fallow showed 26.2 per cent run-off and a loss of 64.79 tons per acre. On corn land the soil loss was 17.22 tons per acre.

At Woodruff, S. C., the Soil Conservation Service, in co-operation with the state experiment station, has experimental plots with about a 7 per cent slope on a sandy clay soil. From a 3.85-inch rain the percentage of run-off and soil losses per acre were as follows:

	Run-off Water Per Cent	Soil Loss Pounds
On lespedeza, second year ...	15	800
On corn land	48	17,400
On cotton	62	31,400
On bare soil	88	39,000

These simple facts on water run-off mean a great deal. While usually there is rainfall enough to make a crop, a great deal is lost and never does any good. Lost rainfall is worse than wasted; it carries with it the good soil. And with the good soil goes the farmer's capital. In the area from Virginia to Alabama nearly 100,000,000 acres of land are being so badly eroded that they won't be worth farming by the next generation. Something like 4,000,000 acres have already been ruined beyond repair.

Every time a raindrop hits bare soil, it stirs up the fine soil particles and sends them on the way down hill. But when such

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a drop hits vegetation it breaks up and the fine spray settles down and sinks into the soil. There is no better protection against erosion than vegetation.

A heavy grass sod is best to stop erosion but lespedeza is nearly as good, and while it won't bring back lost acres, it will help to stop more loss.

The soil conservation specialists advocate "strip cropping." A strip of lespedeza between strips of cotton or corn is not in the way, will hold back the rush of water, and yield seed or hay if needed. If not so needed the crop can be left for soil improvement. The next season the strips can be shifted, putting the hoed crop where the lespedeza was. In this way it is possible to raise as much cotton on half the acreage and to save the whole from washing. And while lespedeza helps to stop the loss, it is also helping to put the land in shape for bigger crops. It has been estimated that a crop of lespedeza, even after half has been taken off by grazing, will leave as much nitrogen in each acre as 200 pounds of nitrate of soda.

Records collected from actual farm experience in North Carolina and Tennessee show that the yield of cotton after lespedeza has increased an average of 142 per cent and of corn an average of 115 per cent. These records come from the experience of farmers who have used lespedeza. They are real, not theoretical. The average yield of cotton in the states from North Carolina to Louisiana in 1935 was only 0.42 bale per acre. Lespedeza can easily double that yield if given a chance.

In 1930 there were in North Carolina 127,000 farms without a cow; in Georgia 100,000; in Mississippi 145,000. Probably the record is not much better today. Of course there are various reasons for this, but with lespedeza growing so readily on land laid out of cultivation, the lack of forage ought no longer be one of these reasons. Many farmers in the South still pull corn fodder. With no more work they could have lespedeza hay, and it is *good* hay, too.

The South needs more lespedeza to help prevent soil loss, to improve yields, and to produce good hay.

Farming without Soil

Condensed from California Cultivator

D. J. Whitney

THE discovery that plants could be successfully grown in water, without any soil, has attracted much notice during the last two or three years. It is generally known that tomatoes are being grown very successfully for the winter market by this method on a commercial scale.

Recently the originator of this method, Dr. W. F. Gericke, of the University of California, coined the word hydroponics to apply to the system. This means water culture, or water farming. The term probably will never be used except in science and as yet some good way to describe the system in two or three words has not been found. We can say that it is the system of growing plants without soil, or producing crops in nutrient solutions, but both of these terms are somewhat unsatisfactory.

The system consists of growing plants in or over shallow basins from which they get the water and plant food that they need. One would think that if a plant were supplied with rich soil containing all the water that the plant could need, as vigorous growth and as fine production of flowers and fruit would be produced as is possible. This, however, is not true, because plants can apparently get their plant food from water more easily than they can from the best and finest soil; therefore when plants are grown under this water system an unbelievably heavy production is often secured.

The system, to date, is used commercially only for growing tomatoes under glass for the winter markets, but it can doubtless be expanded to grow fruits, vegetables and flowers commercially in this way, not only for the off-season market, but in their regular season. A large variety of crops have been grown very successfully in an experimental way, most of them out of doors in their normal growing season.

For generations scientists and gardeners have been interested in the possibility of growing common land plants in water, but until recently nothing much has been done other than to conduct a few experiments. One trouble may have been that usually experiments were conducted in-

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doors, with growing conditions far different from those to which the plants were accustomed.

In the course of his work in the Division of Plant Nutrition at the University of California Dr. Gericke wanted to grow certain plants in water so as to try some experiments in plant nutrition. He read everything he could find on the subject, trying to discover a satisfactory method for doing this, but got nowhere, so he applied his mind to the problem of working out a new method which would be satisfactory and the present system is the result.

The system can be described in a general way as follows: A shallow basin is provided to hold the water and the plant food for the plants to use. Immediately above this, as a support for the plants, is stretched woven wire.

Upon this wire is placed peat moss, straw or some such substance to provide a satisfactory starting bed for the seeds or other parts of the plants to be grown. Rice hulls are excellent in preventing evaporation and in providing material in which the young plants can start.

The young plant starts with a green shoot that begins its work of turning light and air into plant tissue. Roots start downward through the wire screen into the water, from which the plant gets the moisture and the minerals it needs. Plants are able to absorb this water and plant food to so great advantage that they grow with great vigor, provided the root temperature and the air temperature are right and there is sufficient sunlight. Plants can also be grown astonishingly close together by this system and do well.

An essential feature of the system is to get the plant food in solution in the water in the right amount. Too much might be injurious; too little would mean starvation of the plant. However, once the plants have made a good start the composition and amount of plant food is of less importance.

A so-called complete fertilizer is supposed to provide nitrogen, phosphorus and potash. Almost always it carries some sulphur, lime and other materials. Plants also need other elements besides these, but they are supposed to find a sufficient amount of them in the soil, as a rule, but when there is no soil, and everything has to come from water, the composition of the fertilizer applied to the water is more important.

Ten or more elements are added to the water in this system of growing crops without soil. Among the elements not named above are magnesium, iron, zinc, copper, boron (as borax), chlorine, sodium and manganese. Some of these are added in very small

amounts as an excess would be harmful. Nevertheless, a certain amount of nearly every element named should be there.

Most crops will do well with one general combination of plant food. Some require a special mixture. Cucumbers, for example, have not been grown with full success by this method, so experimentation with them is still going on.

After plants get a good start ordinary tap water will often carry them along nicely.

Thus far tomatoes are the only crop grown commercially, and they do so well and command such a high price in the off-season when grown by this method that other crops have not been given commercial attention. However, there is a big field in growing tender vegetables of many kinds for the winter market, and also flowers.

Certain scientific features of this system are most interesting. Wheat, for example, takes up practically all the plant food it really needs in the first six weeks of its growth. After that it needs only water to continue its growth. Dr. Gericke has done a good deal of experimenting with wheat, altering the composition of the water solution at different stages of growth, and he secured some remarkable results in the chemical composition and milling qualities of the wheat. Other kinds of plants can be made the subject of similar experimentation, thus allowing scientists to make tests they long have wanted to make, but have not been able to with plants grown in soil. Wheat, of course, is not likely to be grown on a commercial scale by this system even in the most heavily populated countries.

Every farmer knows that certain places are far more satisfactory for certain crops than are other places. This is due, not primarily to the soil, but to temperature, the amount of daylight, etc., of which temperature is probably the most important. The temperature of the soil may be fully as important as the temperature of the air.

Tomatoes provide an excellent example of this. The climate of the Santa Clara Valley near San Jose is, for example, almost ideal for tomatoes. We have there warm days and cool nights, which is just what tomatoes want. But tomatoes also want a warm soil both day and night. The soil warms up during the day and retains most of that heat during the night.

In growing plants in water the temperature of the air can be governed very well if the plants are grown under glass, and the temperature of the roots can be governed by heating the water in which they grow, so ideal growing conditions can be pro-

vided, giving the greatest plant vigor and greatest possible production of almost any kind of plant. As an actual fact this heating is only required under certain conditions. A very large amount of the experimentation has been carried on out of doors, with plants grown in their regular season and in locations where they can be grown out of doors in soil with success. The water need not be heated under these conditions.

Plants grown in water can be placed very close together so that it would be possible for a family with a very small back yard to grow a very large part of their food in a few basins. Several different kinds of crops can be grown in the same basin at the same time, being planted at different seasons. In cold climates the hardy vegetables like onions and potatoes can be planted first, then beans, sweet corn and summer crops planted as the tops of the onions and potatoes begin to fall. A potato crop may be so heavy that the potatoes will practically cover the wire mesh on which they rest. The fact that the roots can take up plant food so well allows the stems to grow far more closely together than they could grow in soil.

Naturally diseases can be controlled easily when plants are grown like this. This is particularly true with diseases which are held in the soil.

Flowers can be grown as well as vegetables. Off-season table corn may be grown commercially. Fruits and forage crops are not likely ever to be grown commercially in this manner. Papayas, however, are growing nicely under glass in Berkeley.

One of the most surprising features of this system is the comparatively small amount of water that is necessary to grow crops. Scientists used to figure that twenty inches of rainfall were necessary for successful farming, though much land is farmed successfully with far less.

Considering the tremendous yields secured by growing plants this way one would think that much water would be needed. This is not the case, although definite determinations of water needs have not yet been made. For one thing there is no seepage, or waste through the basins, neither is there evaporation from the ground surface after the plants get a good start. Plant food is supplied in sufficient amount so that no excess evaporation is needed from the plants. The water bill for a back yard farmer by this system would probably be less than if he grew a lawn on the same area.

The cost of plant food should also be moderate. The fertilizer for a ton of potatoes grown by this method is estimated at about

fifty cents, and other crops in proportion.

The basins or troughs themselves are six or eight inches deep. The first ones were made two and one-half feet wide and about ten feet long. They have been made from wood, from concrete and other material. They should be of a convenient size, as walks must be provided around each basin so that all parts of it can be reached, and they must be narrow enough so that a substantial support is provided for the wire screen upon which the plants grow. Naturally this cannot be allowed to sag into the water.

Although Dr. Gericke's experiments have been known to many persons, including the writer, for a number of years, certain reasons existed for not publicising the process until recently. However, the fact that this work has been going on for about eighty years and that it has been in successful commercial operation in several places for two or three years shows that this is not merely an interesting discovery.

Production per unit of area may be many times as much as on the best land and the use of water far less than present crops require. If war or domestic tumult does not hinder, or disease overwhelm mankind, the earth might be called upon to support a population twenty times as great as at present, in which event the soil might be needed to produce food for cattle, timber for lumber, fiber for clothes, and cereals and fruits. A very large part of the food requirements of mankind could be grown by water culture on a comparatively small area.

Since food by this system can be produced in abundance almost everywhere except in rugged mountains and in hot, dry deserts, and arctic wastes, one of the greatest problems of mankind seems to have been solved, at least, until such a time as the population of the earth is many times greater than it is now.

That, of course, is the way it seems as far as theory is concerned. The outcome may be very different. At all events a very interesting new method of growing crops has been discovered.

Crops That Taste Bad to Insects

Condensed from Kansas Farmer

A. L. Clapp
Kansas State College

ENTOMOLOGISTS have studied the life habits of insects and have thus been able to suggest means of preventing their spread and to suggest their most vulnerable spot for attack. Through the Extension Service, the Department of Agriculture, newspapers, the radio and their own experience, farmers have learned the chinch bug will not cross a line of tar and therefore can be led to his final resting place, a posthole, by a small black line of tar. They known Hessian fly damage to wheat can be evaded or reduced by planting after the adult flies have laid their eggs in the fall.

Now, we may be entering into a new era. Scientists have known for a long time that an insect prefers certain plants for food. Scientific studies and common observance are teaching us that insects not only prefer certain crops, but often prefer to feed on particular varieties of crops. There are many reasons suggested for this preference, but the fact now is known that the dislike which an insect has for a variety often can be passed on to new varieties through crossbreeding. The production of insect resistant varieties is not likely to entirely take the place of such well-known control means as spraying, dusting, burning and other means of insect control, or of methods of field and crop management devised to reduce losses from insect pests, but only to supplement these older methods of control.

For more than thirty years we have been at work on the problem of developing new varieties of crop plants resistant to plant diseases. Much valuable work has been done in this field, such as development of Kawvale wheat highly resistant to red leaf rust, Thatcher spring wheat resistant to black stem rust, Markton oats resistant to smut, milo and Feterita resistant to kernel smut, Linota flax resistant to wilt, and many others.

It seems likely the next thirty years will see a corresponding development of crop varieties resistant to insects. In fact, much already has been done. A study

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of resistance to chinch bug injury has been conducted at Lawton, Okla., by R. O. Snelling, a graduate of Kansas State College, now employed by the Department of Agriculture. Mr. Snelling's work demonstrated that Atlas sorgo and Blackhull kafir are among the varieties most resistant to chinch bug injury and that milo is the most susceptible. Atlas is a selection from a cross between Blackhull kafir and "Sourless cane," and it has the chinch bug resistance of its Blackhull kafir parent. Atlas, therefore, may be grown in the chinch bug area with confidence that it will suffer minimum damage from chinch bugs.

Combine types of grain sorghum now grown in Western Kansas, such as Wheatland and Beaver, are selections from a kafir-milo cross. They both inherited the susceptibility of the milo parent and are, therefore, not adapted in the chinch bug area. Last summer, Hegari was planted between Blackhull kafir and Atlas in the sorghum variety plots at the Moran Experiment Field in Southeastern Kansas. Bugs killed most of the Hegari plants before they were big enough to produce a stalk, while the Atlas and Blackhull kafirs were damaged little.

A report of Mr. Snelling's work in 1933 and 1934, shows that chinch bugs damaged Harmon White, a Kansas variety of corn, less than any other of the forty-nine varieties in the test. The Harmon White plot averaged seventeen per cent dead plants, Pride of Saline twenty-three per cent, and Midland Yellow Dent twenty-three per cent. These three Kansas varieties ranked first, second and third, respectively, in resistance or relative freedom from injury. Two Pennsylvania varieties had ninety per cent dead plants.

Dr. A. M. Brunson, corn breeder, and Dr. R. H. Painter, entomologist, at the experiment station at Manhattan, have been testing open-pollinated varieties of corn and first generation hybrids for chinch bug resistance. They found that well adapted varieties, such as Pride of Saline, were damaged less than the poorly adapted varieties introduced from other states. Many of the vigorous first generation hybrids showed considerable tolerance to chinch bugs.

Breeding of wheat varieties resistant to Hessian fly is complicated by existence of two distinct forms or races of Hessian fly in Kansas. One form occurs mainly in the hard wheat areas of Central Kansas, while the other attacks the soft wheats of Eastern Kansas. Dr. R. H. Painter says, "Observations on Kansas farms indicate that in the hard wheat belt the soft wheats are less in-

jured by fly than the hard wheats. In the soft wheat belt, the reverse is true." Hessian fly resistance seems to result from inability of the fly to greatly damage the wheat or from the undesirability of the plant as a place to lay eggs. Blackhull wheat plants frequently contain as many Hessian fly "flaxseed" as Turkey, Kanred or Tenmarq, but the "flaxseed" in the Blackhull often are thin and appear undernourished and have not greatly damaged the plant, while those in the other three varieties are plump and have embedded themselves deeply in the plant tissue. Blackhull is, therefore, said to be semi-resistant or tolerant to the Hessian fly. Kawvale wheat provides an excellent example of the other type of resistance.

Kawvale is resistant to the form of Hessian fly generally found in the hard wheat belt, but more or less susceptible to that form found in the soft wheat belt. Yet, by comparison with other varieties, it does have some resistance to the Hessian fly of the soft wheat belt as is shown by results obtained from tests in Eastern Kansas. Kawvale planted on a farm in Leavenworth county had only nine per cent of the culms infested, while Kanred planted in the same test had twenty-six per cent infestation.

Some recent field experiments have shown that Marquillo, a variety of hard red spring wheat, is highly resistant to the Hessian fly as it occurs at Manhattan, in Southeastern Kansas, and in the Illinois-Indiana soft wheat region. Marquillo was developed from a cross between Marquis, bread wheat, and Iumillo, durum or macaroni wheat. Marquillo inherits fly resistance from its durum wheat parent. To utilize the Hessian fly resistance of Marquillo spring wheat in Kansas and other winter wheat states, it is necessary to transfer the valuable character of winter wheats by crossing. Marquillo has been crossed with several varieties of soft red winter wheat and with hard red winter wheats. Several of the selections from these hybrids appear promising as to fly resistance and winter hardiness, but require further careful testing for yield and other crop characters.

The severe outbreak of grasshoppers last summer afforded an excellent opportunity for studying the preference of grasshoppers for different types of food plants. The fact that grasshoppers preferred corn to sorghums was demonstrated in all sections of the state. Badly eaten volunteer corn stalks in fields of sorghum which were damaged little, if any, and undamaged sorghum plants in stripped corn fields attested to the preference of grasshoppers for the corn

plant. Among the sorghums, the kafirs were damaged less than milo and milo derivatives, like Wheatland and Beaver.

Adapted varieties of corn, such as Hays Golden, Cassel, Pride of Saline and Midland Yellow Dent, were damaged less by grasshoppers than were the varieties imported from Iowa and Illinois in the corn breeding plots at the Agronomy Farm at Manhattan during the summer of 1936.

Even the most resistant corn varieties did not approach the resistance of sorghum. In fields of locally adapted varieties, some stalks of corn were not greatly damaged until after the surrounding stalks had been destroyed by grasshoppers. Evidently there is a difference in resistance to grasshopper damage between individual plants in open-pollinated varieties. Experimental corn hybrids of Kansas origin generally showed less injury than those from Eastern states. Resistance to grasshopper damage is a character which deserves consideration in the selection of an open-pollinated variety or hybrid.

"Alkali Disease" Affects Hatches

Condensed from American Poultry Journal

W. C. Tully

Husbandman

FOR a number of years there has been known, in certain areas of the north-central Great Plains, what is called the "alkali disease" of livestock. This name is a misnomer, as recent work has shown that the trouble is not caused by alkali water or alkali soil spots as the early settlers thought. The trouble affects horses, cattle, hogs, and poultry. Eating either grain or forage from badly affected areas causes horses and cattle to develop severely deformed hoofs, and to lose the hair from their tails. The former condition makes work horses useless. In swine, affected grain causes a loss of hair, marked loss of growth, and even death. In poultry, eggs from flocks fed affected grain

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either do not hatch at all or have an extremely low hatchability; unhatched embryos are horribly deformed, chicks do not make normal growth, and egg production is markedly reduced.

Limited areas in South Dakota, Nebraska, Wyoming, and other states are concerned though the trouble is probably most severe in the former state. In South Dakota every case occurred on a certain type of soil known as Pierre clay or Pierre clay loam, though all soil of this type is by no means affected. Farm land on one side of a town may be severely "alkalied"; on the other side is land which produces excellent normal crops. The toxic condition has been known since 1860, though, until very recently, the cause remained a mystery. No detailed survey to determine the extent of the trouble has yet been started.

While some experimental work of a very limited nature was done on this subject as early as 1904, it was not until the late Dr. K.W. Franke started work on it in 1928, and by the writer in 1930, at South Dakota State College, that worthwhile advances were made. For years farmers in certain localities had complained (1) that it was impossible to obtain satisfactory hatching results in chicks either by natural or artificial incubation; (2) that the down on the few chicks which did hatch appeared "greasy" and never fluffed out; (3) and that where higher hatchability was obtained, a high mortality occurred.

First experimental poultry work was with incubation. Twelve dozen eggs were obtained from an affected farm and incubated at the College Poultry Department. The hatchability was less than 4% ! A few of the unhatched eggs were opened and found to contain horribly deformed embryos. An almost constant deformity was the entire absence of the upper beak. But there were unhatched chicks with no eyes, with one eye, with no wings, sometimes with no feet. Occasionally an embryo was found where one or two toes only, instead of normal legs, projected from the body. Leg and toe deformities were very common. Repeated tests of similar eggs showed the same results, while the check lot eggs, set at the same time, always hatched normally.

At this time, of course, the cause of the trouble was not known. It might have been due to any one of a number of causes, or to combinations, but as the feed was suspected, feeding experiments were started in the spring of 1931. While several lots of chicks were run, results of one of the experiments will give a satisfactory explanation here.

Where a ration containing 65% of "alkalied" grain was used, made up of 25 ground yellow corn, 25 ground barley, and 15 ground wheat, together with suitable animal protein, mineral, and vitamin supplements, chicks at eight weeks averaged half a pound lighter than the check lot where normal grain in a ration of exactly similar composition was used. A difference as great as half a pound at eight weeks is very important. However, when only 25% of either affected corn or barley was used, the weight differences were not significant.

The females from the four lots of R. I. Red chicks were continued on the experimental rations for over a year. Two males were also kept in the same pens, as a study of hatchability was of prior importance. At thirty-two weeks, the pullets in the pen fed the 65% of toxic grain averaged over a pound less than the control pullets. The smaller pullets took about two months longer to come into production. At this time, they had laid an average of only one egg per female while the check lot had averaged twelve eggs. For the first sixteen weeks of production, the check lot averaged fifty-three eggs, while the pen fed the toxic grain averaged only six. It is therefore obvious what a terribly serious effect the use of 65% of the toxic grain had on production, particularly during the first part of the production year when egg prices are highest. For the entire first year's production, the check lot averaged 172 eggs per bird, on a hen day basis, and the toxic grain lot 147, an average of twenty-five fewer eggs.

A great many hatches made up of a large total number of eggs were incubated from both the check lot and the toxic grain pen. All eggs from the latter pen produced a very low hatchability, and the unhatched embryos all were deformed to a greater or less degree. This work proved conclusively that some factor in the affected grain was responsible for this very serious trouble.

It is interesting to be assured, however, that this toxic effect is not permanent in birds, where hatchability is used as the measuring stick. Where laying hens that had been on a regular ration continually up to the start of the experiment were fed toxic grain, all the fertile eggs laid for the first three days after this feed was started hatched 75%. But eggs from the next three day period hatched only 28%. None of the eggs, laid from seven to nine days after changing feed, hatched, and deformities were present which with later settings increased in severity until the eggs of the thirteenth to fifteenth days showed malformed embryos as severe as any ever found. When

the pen which had been on toxic feed through life was changed to a normal ration, only fifteen days were required to increase hatchability from 0 to 57% with absence of all signs of deformed chicks.

At the same time as these experiments were underway, the late Dr. K. W. Franke was doing extensive work with laboratory rats on the same problem, as well as other detailed chemical investigations. It had been shown by Franke, and to a lesser extent by the writer, that selenium, one of the rarer chemical elements, was responsible for all this trouble.

Sodium selenite, one of the commoner compounds of selenium, was fed to chicks. A ration containing eight parts of this per million was sufficient to depress growth in chicks significantly. When twenty normal, producing R. I. Red hens were fed twenty-six parts per million of sodium selenite in their ration, they lost an average of over a pound in weight in two weeks. In a second experiment lasting eleven weeks, fifteen Leghorn pullets were fed sodium selenite at levels of from 3.25 to 6.5 parts per million of an all mash ration. The average weights of the pullets decreased, and during some weeks, pullets ate only one-third of one pound of feed per week. (Over 1.5 lbs. is about the average feed consumption per bird per week.) Who said that pullets do not have highly developed senses of either taste or smell! Sixteen settings, a total of 305 eggs, were made from this pen. Deformed embryos were obtained similar to those when 65% of "alkalied" grain was fed, but in no cases were the deformities so severe.

Many other extremely interesting experiments have been conducted. For example, the injection into hatching eggs of exceedingly minute quantities of selenium salt solutions has produced deformed embryos, while not quite so severe, yet typical of those from birds which were fed the toxic grain.

Halting March of Mormon Crickets

Condensed from The Western Farm Life

Myra Pinkerton

THE intermittent march of the Mormon crickets over sagebrush hills and plains of Utah, Montana, Idaho, Nevada, Wyoming and Colorado, occurred long before the white man settled in the West. And these moving armies of insects, like the swarms of grasshoppers and locusts, destroy the crops and range feed as they go.

Approximately a million acres are infested in Moffat county, Colorado, where the Elk Springs CCC camp is located. One of the projects of the camp is the destruction of these insects.

In 1935 the cricket control work was carried on in the more accessible places near the camp. But last year a fly-camp was located on Blue Mountain, a high broken plateau east of Green River and south of Yampa. This is said to be the original home and breeding place of the Mormon cricket. An intensive program is being carried on there.

The first recorded outbreak of the pests in northwestern Colorado was in 1903. In 1923, a campaign was begun to eradicate the cricket from that part of the state. It was abandoned, however, until 1927. Again, in 1931, the fight was discontinued, partly because of lack of funds, and partly because it was thought that the insects were under control for some time to come. But the swarms of crickets have again reached alarming proportions as they march over the land, leaving devastation behind them.

There are various methods of control, but the ones used by the CCC workers have proven to be the most effective after several years of testing.

One method is the dusting of insects with a compound of three parts hydrated lime with one of sodium arsenite. The "dust" is rather dangerous to mix, but the work superintendent has utilized for the purpose a new cement mixer that is part of the camp equipment.

Twenty-eight hand sprays have been used. The best time to spray is during the early morning or evening or on cool days. The men walk over the cricket area, working when a breeze is blowing, so that the dust is blown away from them and over the insects.

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Soon after the poison touches the cricket, it begins hopping about. Later it quiets down. Licking its front feet, it rubs them over its body in an attempt to remove the *dust,* and in this way gets the dose of poison. It takes from 40 to 70 hours to kill the cricket by the dusting method.

Another method used is the erection of barriers and traps. Tin is one thing that the adult cricket cannot climb. Tin fences, 15 inches high and of various lengths from a few yards to a mile or more, are put up some distance in front of the marching cricket band. At intervals along the barrier, wing walls lead to pits or traps about four feet square and the same in depth. The traps are surrounded with tin.

Watching the crickets enter one of these traps, I counted 200 of them in one minute, and there were three openings to that one trap. The insects flowed in—600 of them every minute.

The men get behind the crickets and drive them toward the barriers, by waving gunny sacks, rattling tin cans or beating the ground with brush. When the traps are full, oil is poured on and the mass burned. Or if covered with dirt, the crickets will die in about twelve hours from heat, suffocation and fighting among themselves.

The exact time of the beginning of the march is not definitely known. The swarms usually begin to appear in May. It has been said that the insects will travel over anything within their line of march. This is not entirely true. Although they travel in a general direction, they sometimes follow the course of a river. And they are turned by barriers. Farmers protect gardens and crops by building tin barriers around their field yields. The crickets do, however, swarm over buildings, trees and other obstacles without changing the general direction of their march.

The largest swarms travel the fastest and the greatest distance, the hoards in the rear crowding the leaders to a more rapid pace.

The swarms vary in size. One of the largest, near the Elk Springs camp, was found to be about four miles in depth with a one-half mile front. Occasionally two or more swarms will join. They travel about three-quarters of a mile a day and often cover as much as forty miles in a season.

During the night and also during the hottest part of the day, the crickets halt their march and climb into weeds, bushes, trees, or bunch up in the shade of sagebrush and remain quiet.

The marching swarm gives the hillside, valley or road the appearance of an undulating stream of water. It is a black flow of millions of crickets, the forward movement of these insect armies.

Although the crickets have two sets of very short wings hidden under the cape or pronotum back of the head, they do not fly. In their march, when they are undisturbed, they walk.

The moment they are disturbed, however, they begin hopping about and making a noise very much like the faint squeaking of a spring. This sound is made by the male rubbing one wing over the other. It is used as a warning and to attract the female during breeding season. The female makes no sound.

The insects range in color from a reddish-brown to almost black. During the life span, which is one season, they shed their skins six times, and with each change the color varies. In the last instar the insect is almost black.

The adult cricket measures about two inches in length. The female has a tail or ovipositor that is slightly curved and about an inch long.

The bloom of the female is a white jelly-like substance received from the male during copulation. These white masses on the female are an indication that the egg-laying season is about to begin. Satisfactory control methods should take place before this season; although it was found that a majority of the eggs were not fertile if the crickets were disturbed during the breeding period.

This starts about the middle of July. After that time the orderly march is discontinued, and the crickets mill about from breeding ground to feeding places.

The fertile eggs are brownish in color and about one-quarter inch long. The female deposits the eggs in clusters, loosely in the soil to a depth of about one inch, by inserting her ovipositor into the ground. Some of the eggs protrude slightly. One female will carry from 100 to 200 eggs in different stages of development. They are laid at various periods and places.

Mormon crickets prefer to lay their eggs on dry hill tops or hillsides where the ground is not too hard. Between 2,000 and 3,000 eggs were found in a square foot of surface ground after the crickets had finished the egg laying.

The newly-hatched insect is a light flesh color. It soon turns dark, with only a light stripe down its back. The young cricket is about the size of a house fly, with elongated body.

Crickets eat leaves of plants, grass, sage and vegetables. The plants which they do not eat, they injure and destroy by breaking and tramping over them.

Raising Calves on Wire Floors

Condensed from New Jersey Farm and Garden

H. H. Tucker

PROGRESS in any industry comes about either from new ideas and developments, or the adaptation of ideas or principles used in other industries. Poultrymen have been using wire floors for some time with much success, and it is from the poultry industry that the idea of wire floors has been taken and is now being used in the dairy industry. Wire floors made of sufficiently rigid material may be used at some later time for cow stalls, but at present these have been used only for calf floors to any extent.

The Northern Branch of the New Jersey Agricultural Experiment Station was not in a position to remodel its calf barn, and, realizing that many farmers are in the same position, it decided to adapt this same principle in a way which could be used in almost any dairy barn. This has been accomplished by constructing frames on which wire floors are fastened.

The wire used for these floors is three-quarter-inch mesh wire cloth made from No. 11 wire, galvanized after weaving. Such galvanizing is a great factor in protecting and prolonging the life of the wire. These frames are constructed of 4″ x 4″ material to give strength. They are made four feet wide to correspond with one of the usual widths of wire cloth, and approximately five feet long so that they will not be too heavy to handle and can be easily removed for cleaning. These frames are morticed at each corner to give a rigid construction and are placed on four legs, six inches in height and made from the same 4″ x 4″ material. The wire is stapled very securely to the top of these frames after No. 9 wire has first been stretched over the frames. This No. 9 wire is used to strengthen the floor and help carry the load to be put on these wire floors. We now have calves weighing 250 pounds on such wire floors. Heavy woven wire fence four feet in height may be used for this purpose, or more preferable would be No. 9 wire stretched individually at distances of four or five inches over the frame in both directions.

After the wire has been securely fastened, a 2″ x 4″ is placed on edge along each side of the frame to aid in holding the

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bedding on the frames. These 4″ x 4″ frames, six-inch legs and 2″ x 4″ side rails are then bolted securely together by ½″ x 14″ bolts at each corner. A twelve-inch bolt could be used by countersinking the head of the bolt two inches into the leg of the frame.

These frames, when completed, are placed end-to-end along a panel or wall where the calves can be tied. Long straw, swamp hay, or other similar bedding is used on this wire to a depth of three to four inches and makes an ideal bed. Of course, finer beddings could not be used successfully, since they would fall through the openings in the wire cloth. The bedding does not have an opportunity to absorb water to any extent and always makes a dry, warm bed for the calves. The fact that these frames are held up six inches from the floor permits ventilation under the frame and further aids in keeping the beds dry and warm. This also permits sweeping out, by means of a brush, any bedding which may sift through the wire floors. In this way drainage is not hindered and water runs readily into the gutters.

Since this bedding does not become wet, it is necessary to change it only once every seven to fourteen days, depending upon the size of the calves. We find that calves on this floor lie down almost twice as much as calves on well bedded, insulated floors in adjoining pens.

Calves are fed milk from the Coyner calf pails, which have rubber nipples. One of the advantages of this method is that no time is lost in teaching the calf to drink, since it is natural for a calf to nurse. It is not necessary that one single feeding be missed in this transition period. Another advantage is that the milk is consumed more slowly and evenly with the head in a position so that the milk is taken directly into the true stomach. It therefore does not become mixed with other feed in the paunch which often causes indigestion. No trouble is experienced in getting a calf to drink water later, since it will start of its own accord. Grain and hay are fed in galvanized pails which may be removed very readily for cleaning.

Much room is saved by this method of raising calves. We have twenty-four calves on ninety feet of frames and do not have them crowded.

There is a further saving in bedding and labor. Calves raised under this method use only one-third to one-fourth as much bedding as when raised on solid floor. This type of wire cost 19½c a square foot in rolls. When this is added to the cost of lumber, staples and bolts, there is a total

cost for materials of about $5.50 for a five-foot frame. With baled straw at $14 a ton the straw saved in six months will pay for the cost of materials, and the labor saved in this same time will more than pay for labor required for construction. We cannot say how long this wire or these frames will last. However, these frames have been in use for more than two months and do not show signs of wear or breakage. It seems that two years is a very conservative estimate of the time these wire floors will last under heavy use.

Other materials have been considered for constructing this type of floor, such as metal for frames, expanded sheet-iron similar to wire lath but made of heavier material, and copper-bearing perforated sheet-iron for floors. However, the most practical at this time was thought to be the materials used. Further saving and improvements may be made by use of other materials or by wholesale manufacture.

The savings of labor, bedding, etc., obtained by this method are of course very important but are relatively small when compared to the improved health, greater gains and more rapid growth of the calves. Young calves are delicate and almost all the troubles encountered in raising calves are due directly or indirectly to unsanitary conditions. Cold, damp beds cause colds, pneumonia, and some types of scours. Damp bedding is an ideal place for the development of bacteria that further spread disease or reduce the calf's resistance to disease. It is particularly important to prevent such conditions, especially during the early part of the calf's life, and we are finding wire floors a very great factor in helping us obtain the best conditions for growth and development, as is evidenced by the condition of our calves.

The Effect of Late Summer and Early Fall Cutting on Crown Bud Formation and Winterhardiness of Alfalfa

A Summary Condensed from Journal of Agronomy

Val. W. Silkett, C. R. Megee, and H. C. Rather

The cutting of alfalfa in late summer and early fall in the northern sections of the United States is frequently practiced, especially when hay is scarce and high in price. A short growing season in this section generally limits production to two cuttings, but occasionally three or even four cuttings may be taken. This, at times, results in a reduction of the stand due to winterkilling, a decrease in yield the following year, or both. In Michigan, the third cutting is generally removed in September or October and in southern Michigan, where harvesting three cuttings is often the rule, a fourth cutting is sometimes taken late in the fall. These experiments were planned to see what effect the date of the fall cutting might have upon the yield and winterkilling of the alfalfa.

The results of these experiments showed that cutting between September first and fifteenth resulted not only in a reduction in yield the following year but also in an increase in the amount of winter-killing and heaving of the plants. However, if the plants were cut in October, very little, if any, bad effect resulted. The differences were largely due to the condition of the roots. The roots of the plants cut in September show a much larger percentage of water present, while the percentage of stored food was much less. The presence of the water made the plant more susceptible to winter killing, while the absence of stored food prevented the plants from making a good growth in early spring.

It must, of course, be borne in mind that seasonal weather conditions may influence the exact date of cutting. Also the plants cut in September developed fewer crown buds than those cut in October, or none at all.

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Inherited Susceptibility to Mastitis

Condensed from The Journal of Heredity

W. T. White and Herman L. Ibsen
Kansas Agricultural Experiment Station

The Alaska Agricultural Experiment Stations, with headquarters at Sitka, began in 1917 the cross-breeding of Holstein and Galloway cattle with the purpose of producing a hardy dairy cow. The work has progressed to a point where calves of the fourth and fifth generation are being born. During the course of the experiment three cases of acute mastitis occurred amongst related animals. This suggested the possibility that susceptibility to the disease is inherited.

The three animals concerned were a dam, daughter and granddaughter, and in all three the mastitis was so severe that the udders eventually became entirely non-functional. A pure-bred Galloway cow, No. 140, Bertha A., mated to the Holstein bull, produced an F_1 female No. 21, her only daughter. This F_1 female, No. 21, was later mated to the F_1 bull, No. 33 (her half-brother on the sire's side) producing the F_2 female, No. 48, also an only daughter. All three of these females, dam, daughter, and granddaughter, exhibited similar clinical symptoms of the disease.

Both the dam and the daughter had udders that, from the standpoint of dairy quality and conformation, would be judged rather undesirable. The dam's udder was pendulous and meaty in texture, while No. 21, the daughter, would be criticized for having not only a loosely hung, pendulous udder, but one of poor conformation, and deficient in size. The granddaughter, No. 48, on the other hand, had an udder the appearance of which was rather desirable from a dairy standpoint, and could be criticized chiefly for being too loosely hung posteriorly to the body.

The dam, No. 140, lost the left rear quarter of her udder early in her second lactation, due to what was at the time believed to be a chronic case of mastitis. The right rear and right front quarters were affected and gave no milk in her third lactation, and the remaining left front quarter became non-functional during her fourth lactation. The daughter, No. 21, lost one quarter in her

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first lactation, a second quarter in her second lactation, and the remaining two quarters so early in the third lactation that she was fattened and slaughtered after having been milked less than thirty days. The granddaughter, No. 48, gave 5109.3 pounds of milk in the 287 days of her lactation, which began when she was 33 months old. She seemed perfectly normal when finishing her first lactation, the only possible exception being that the lactation period was somewhat short of the usual 365-day period reached by a number of the F_1 and F_2 heifers. However, beginning with the sixty-third day of her second lactation, an aggravated case of mastitis developed and the entire udder was lost. Both of the calves dropped by No. 48 were males. Except for these three cases no example of mastitis of such marked virulence was found in any of the several hundred other cows bred by the Alaska stations. The original purebred Galloway cow, No. 140, had been bought, and nothing was known concerning the occurrence of mastitis among her ancestors.

According to Hucker, it has been estimated that about eight cows per thousand per year have the acute, or clinical type of mastitis. He makes the following significant statement:

One interesting observation in connection with the clinical type of mastitis is the fact that it rarely spreads through the herd. It occurs in isolated instances, and, although the cow has been in the milking line previous to infection, adjoining cows rarely become infected.

The sub-clinical (sub-acute, chronic, latent, etc.) form of mastitis, however, is much more prevalent, and in certain tested New York herds Hucker states that from 20 to 90 per cent of the individuals have been found to be infected. In this form, also, he is of the opinion that the evidence indicates that its spread by contagion or infection is comparatively rare.

Both the observations of Hucker and the results herein presented agree with the assumption that predisposition to acute mastitis is inherited, and, based on the three cases cited, it also seems legitimate to assume that one or more dominant genes are responsible for the susceptibility. There is the possibility that susceptibility to the milder forms of mastitis is inherited, but no evidence on that point is available at present. Until more critical data are obtained it seems useless to theorize on the possible interrelationships of the genes affecting susceptibility to the two main types of mastitis.

It has not been mentioned previously that both the daughter, No. 21, and the granddaughter, No. 48, had full brothers, and that none of them were retained for breeding purposes since they were not of the type desired in the original experiment. If one had been kept, there would have been a fairly good possibility that he was at least heterozygous for the postulated dominant gene (or genes), and in that case one would expect a large proportion of the daughters to have mastitis of the acute type. Bulls from such mothers are rarely retained for breeding in any herd.

The results herein presented are not by any means conclusive. The main purpose is to call attention to the problem, with the hope that data of a more critical nature will be accumulated eventually by other workers. If the results are amply verified, and the mode of inheritance of the susceptibility therefore definitely known, it will mean that the geneticist can be of more value than the veterinarian in producing dairy animals free from this objectionable disease.

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